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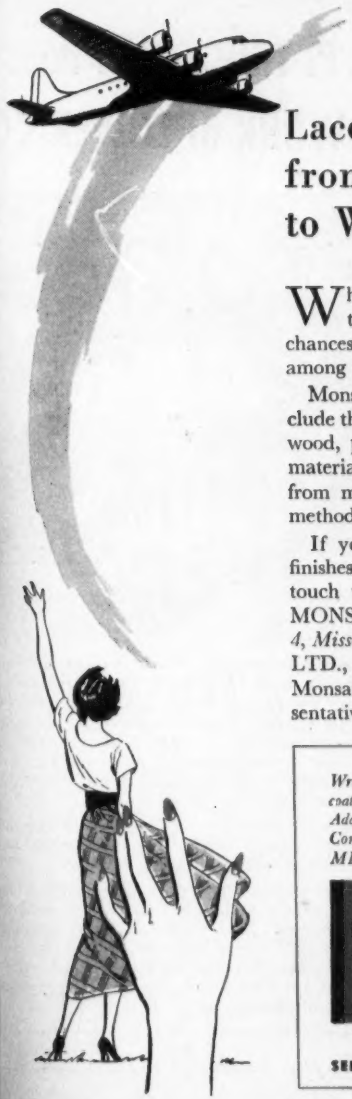

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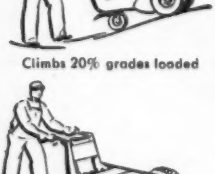

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Dear Reader:

In the July and August issues, we have been been promising to bring you a Report to Management on design for lower cost. Now - if costs are important to you, if rising costs make cost reduction a pressing problem, turn to page 55 for "Better Product Design Means Lower Costs, Higher Quality".

The symbol - labeled Higher Productivity, Lower Costs - that appears at the lead to the report tells the story. This cost-cutting symbol will show up for months in Digest editorial pages. And in every case it will call your attention to another cost-cutting feature.

Every phase and every industry will be covered - from management's viewpoint as well as from engineering's and production's. On pages 20 and 46 you will again find the symbol.

In the January issue, we shall bring you a 24-page editorial bonus in the form of a special "cost-cutting" insert. Look for it, keep it, use it - to get higher productivity, lower costs.

John F. Chapman

Publisher

SEPTEMBER, 1949

VOLUME 4
NUMBER 9

Member — Audit Bureau of Circulations

McGraw-Hill Digest is published monthly by McGraw-Hill International Corp. for circulation in all countries except the United States and Canada. Publication and executive offices, 330 W. 42nd St., New York 18, N. Y., U.S.A. James H. McGraw, Jr., President; Eugene P. Warner, Vice-President and General Manager; James L. Gilbert, Senior Vice-President; John F. Chapman, Vice-President; George Quisenberry, Vice-President; Curtis W. McGraw, Treasurer; Joseph A. Gerardi, Secretary; J. Clifford Stark, Assistant to President; K. Presbrey Bliss, Vice-President and Director of Advertising; J. E. Blackburn, Director of Circulation. *Subscriptions may be ordered through Director of Circulation, through local book dealer, or McGraw-Hill, Aldwych House, London, W. C. 2 (British only.)* Subscription rates: $5 for 1 year, $8 for 2 years, or $10 for 3 years; single copy 50¢ (U. S. currency). Entered as second-class matter December 17, 1947, at the post office at New York, New York, under the Act of March 3, 1879.

John F. Chapman *Publisher*
Harry S. Wharen *Editor*
J. H. McKee, Jr. *Managing Editor*
Dexter M. Keezer *Economics Dept.*
Russell F. Anderson *Editor, World News*
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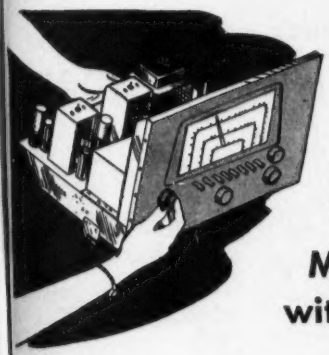

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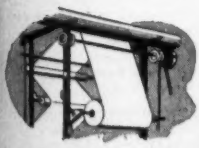

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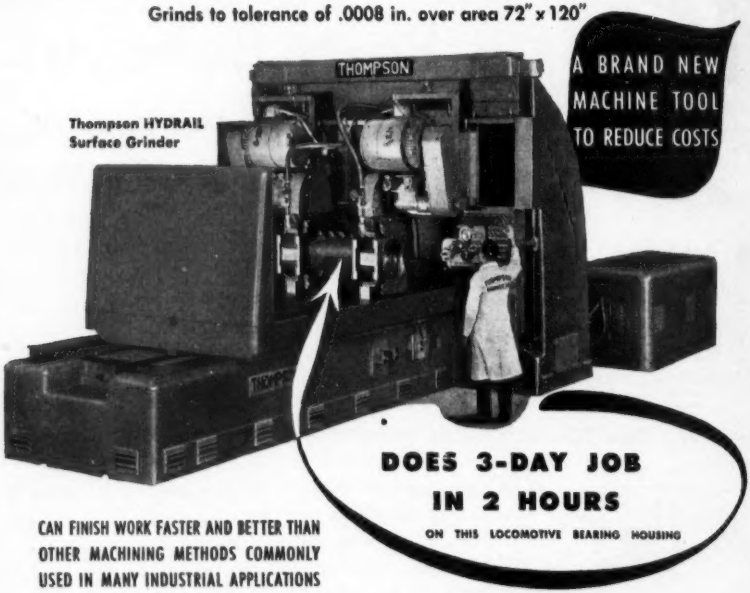
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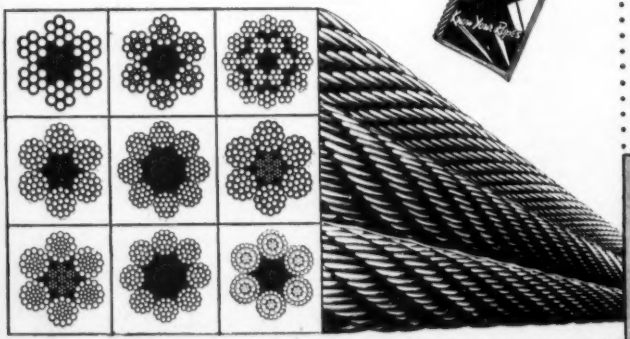

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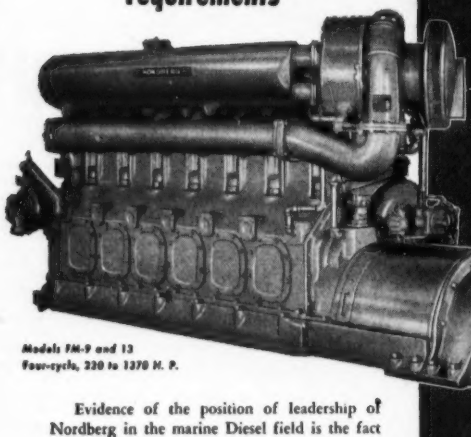

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Business Trends

GREAT BRITAIN'S DOLLAR CRISIS (and Europe's) is deepening. As this situation becomes more and more serious, two basic facts become clearer:

(1) British efficiency is now below 1939. Britain's manufacturing costs have moved upward steadily, while the U. S. has held its own and is now improving. This spring's reduction in costs and prices has improved the U. S. position in competitive markets.

(2) The Marshall Plan, or even dollar-aid plans, cannot stave off a similar shake-down of costs for most European countries. With it may come some cuts in production and employment, but they will probably be mild, as the business setback in the U. S. has been.

That production costs have risen has been dramatically revealed by The (London) Economist. An average British worker, it estimates, must now work 213 weeks to buy a standard house, as against 112 weeks before the war. The cheapest British car costs him 55 weeks' wages, as against 39 prewar. An average radio set costs him 4.5 weeks of work, as compared to 3.5.

This means that it takes more work, more time, to produce something in Britain than it did before the war—a lot more work in some cases. It means that the British people themselves cannot afford to buy Britain's goods as they could before the war. Britain's world customers are in the same position.

The American picture is different. The average U. S. worker can buy a house with 147 weeks' wages, compared to 169 weeks for a similar house in 1939. A car costs 34 weeks' pay, as against 33 weeks before the war. An average radio costs much less—4 days against 10 in 1939.

Controls and planning have insulated British companies and workers against competition. With no pressure to hold them down, costs have soared. Much of Europe is in the same way. The result: Prices of Austrian, German, Italian, Spanish and English cotton goods have been 10-30% higher than American prices. American coal for ships' bunkers undercuts British in price.

It has taken drastic deflation—real economic distress—to shake down inflated costs and prices after other wars. The Marshall Plan was designed to avoid this for Europe. It was to help Europe get competitive again by rebuilding plants, supplying raw materials, supporting currencies.

But the Marshall Plan, it is now clear, cannot do the whole job alone. (For Washington's viewpoint, see p15.) Europe almost certainly will go through a period similar to that which the U. S. has had this spring. The setback here was healthy, bringing down inflated costs and prices without too much unemployment or distress.

The Marshall Plan puts a "floor" under Europe's economy and living standards. That—plus the world's still far-from-satisfied demand for consumer goods

Business Trends (Continued)

and for capital equipment—will prevent any recession from going too far. Europe, the evidence indicates, does not need too big an adjustment. A cut of 20% in textile, automobile, machinery, and other lines would probably be enough to make many European products again competitive.

There are two dangers in the process: (1) Marshall Plan nations may cut their buying of capital equipment. In the long run, new equipment—the basic way of cutting costs and improving efficiency—is the only hope of increasing production and improving living standards. Cuts here would prolong any setback in business. (2) Governments may hang onto controls too long. The longer these inflexible controls last and the more rigid they are, the more difficult the adjustment will be.

U. S. CONSUMERS have been the mainstay of U. S. business. They have bought about as much at retail this far into 1949 as they did in 1948. Dollar volume of retail sales is about the same; the number of units moved is actually larger. This has kept key industries—automobile and homebuilding, for example—at peak. In fact, the automobile and construction industries will probably set new production records in 1949.

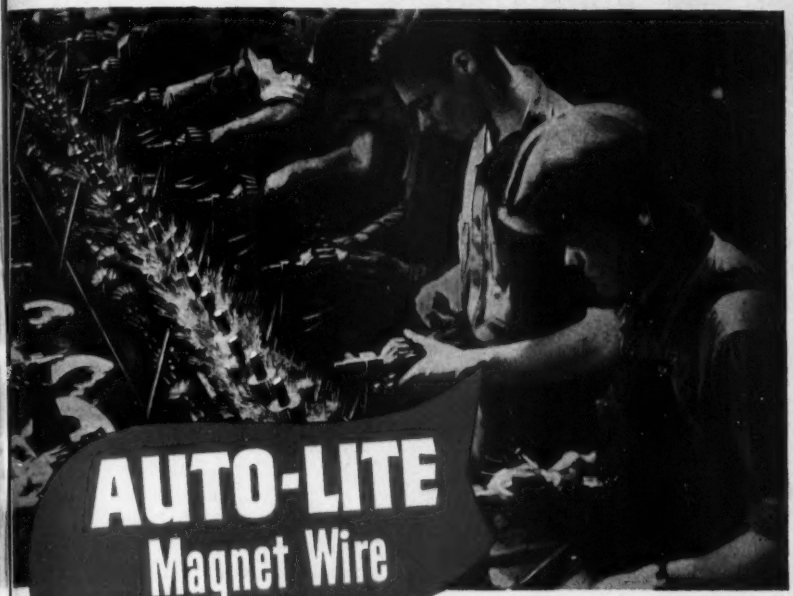
As shortages disappeared and prices turned down, business slowed its buying, lived off inventories on hand. This slump in buying for inventory has accounted for two-thirds or more of the 13% drop in industrial production.

Inventories, however, were not high. Even at 1948 peaks, they were not large in relation to volume of sales. As a result, inventories in many lines are now well below "normal." In many lines, 6 or 7 months is probably the longest that business can go before beginning to reorder in volume.

That suggests production may pick up as early as this fall, instead of 1950. The turn has come in several lines—rayon and some other textiles and apparels, nonferrous metals, some construction materials. By October and November, production may again be on the upswing.

The pickup in purchasing will help to ease the dollar shortage abroad. The sterling area as a whole has not been selling the U. S. as much raw material as before. The colonies are the big suppliers. Copper, rubber, fats, cocoa—a long list of commodities—have been cut in price and volume as U. S. industry settled back to reduce inventories.

But reviving demand will not take prices back to 1948 peaks. World suppliers may sell more commodities for dollars, but prices will not rocket upward again. Copper, for example, has risen lately to 17 cents-plus, but it is unlikely to go much higher, certainly not to the peaks of last year. The price pattern, too, will vary from commodity to commodity. Some may climb in the next few months, as the nonferrous metals have, but others seem headed downward. Prices of still other commodities, such as insecticides, seem to be stabilizing.



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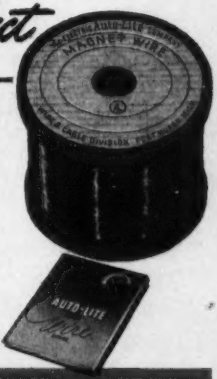

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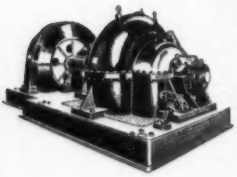

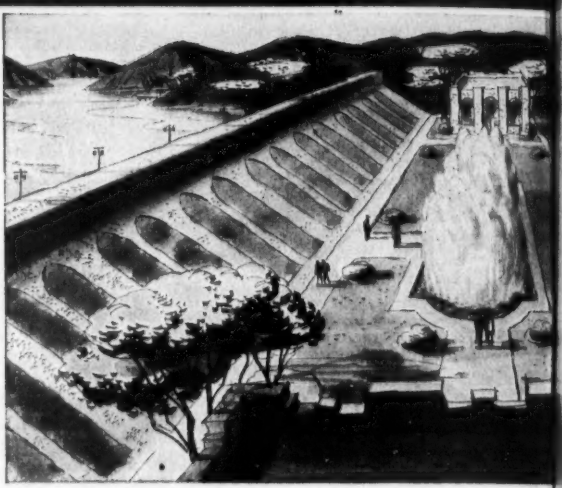

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Flour and Sawmill Equipment

Washington Report

PRESIDENT TRUMAN'S "POINT FOUR" program for exporting U. S. show-how and capital into under-developed areas of the world is going forward even though the U. S. Congress, for domestic political reasons, is not implementing it. The World Bank, under its new president, Eugene R. Black, is taking the responsibility.

Black sees the reconstruction side of the bank's job as just about finished. So he is turning the bank's operations toward new development. You see this best in the bank's mission to Colombia. It is the first mission sent out with the broad objective of "making a comprehensive survey of a nation's over-all economy with a view of recommending ways to increase the wealth of that country."

Another example of the bank's point four activity is a loan for Britain's Colonial Development Corp. It will get dollars with which to buy U. S. construction equipment to be moved from place to place wherever the corporation elects to build highways, railroads, port facilities, and the like.

YUGOSLAVIA WILL GET DOLLARS and U. S. equipment to carry out Tito's industrial-development program. The methods may be devious, but Secretary Acheson has concluded that the breach between Tito and Stalin is beyond healing, that it is to the West's interest to capitalize on that breach. Tito has two applications in for dollar loans from the World Bank, another application with the Export-Import bank. Also, he is negotiating with several U. S. commercial banks.

U. S.-U. K. TALKS in Washington this month and the meetings of the governors of the World Bank and the International Monetary Fund will cover Britain's dollar troubles. Cripp's July action in cutting sterling-commonwealth dollar buying 25% was really just a stop-gap for getting by until these talks.

Devaluation of the pound sterling is an inevitable, integral part of any final solution. But the weight of opinion among participating officials is that devaluation is the second, not the first, step. More urgent than devaluation are long-term revisions in trade patterns to bring the exchange of goods between dollar and sterling areas into equilibrium.

That the U. S. will not let Britain down is certain. But there is an uneasy awareness that buying more time to let things work themselves out will not help. During the summer, the groping for a solution was still in terms of the traditional approaches—another loan, U. S. transfer of gold, stockpile buying. No one came up with anything unorthodox—as Roosevelt might have—such as, perhaps, a 99-year U. S. lease of Bermuda for a half-billion in gold a year.

INTER-EUROPEAN PAYMENTS SCHEME worked out at Paris for the 1949-50 Marshall Plan year is a step in the direction of freer trade—but, at best, it is only

Washington Report (Continued)

a short step. Here is the story: Ambassador Harriman talked the British into going along on transferability among Marshall Plan nations of up to 25% of ECA conditional aid, with the additional string on how much can accrue to certain nations, notably Belgium.

Thus France with, say, initial drawing rights of $100-million in pounds sterling on Britain, can transfer up to $25-million in drawing rights to, say, Denmark. France cannot, however, convert any of her drawing rights into dollars for use outside the participating countries.

ECA Director Hoffman and Harriman wanted completely unfettered transferability of conditional aid. They knew this wasn't possible this year. Cripps, for Britain, wanted to continue the first year procedure of no transferability. He particularly insisted upon establishing, as a condition to giving in on any transfers, a ceiling on the amount accruing to the Belgium-Luxembourg economic union.

AID TO EUROPE took 16 cents of every dollar the U. S. government spent in the 1948-49 fiscal year. That was the third largest chunk of the American taxpayer's budget. The armed services cost 34 cents. The rest of the dollar was spent as follows: 6 cents for social security, 13 cents for veterans' benefits, 13 cents to service the public debt. For the 1949-50 fiscal year, the breakdown will be roughly the same; there will be a little less for European aid and probably for veterans, a little more for the military.

INTERNATIONAL GLIMPSES

Italy and France have joined the trek of nations seeking U. S. hybrid corn and wheat seed. Two experts from each country have come to Shenandoah, Iowa, for a 6-month session with the United Hybrid Corn Growers Association.

South Africa is talking with Export-Import Bank over a $100-million loan to expand chrome and manganese production and export. Original proposal for a general balance of payments loan got a cold reception both at the bank and at the State Department.

State Department is urging the Italian government to grant concessions to American oil companies that want to help develop the Po oil fields. Standard Oil of New Jersey and Socony Vacuum have indicated interest in investing money in the recent strike there.

We pay our respects, in closing this report, to the memory of our co-worker and the man who until now has written these pages for you—Thomas Falco. Falco was one of the 13 U. S. newsmen killed in the crash of a KLM Dutch airliner outside Bombay, India, on July 12, enroute home after a month's on-the-spot reporting in Indonesia. We regret his loss as a friend and as a conscientious journalist.—The Editors.

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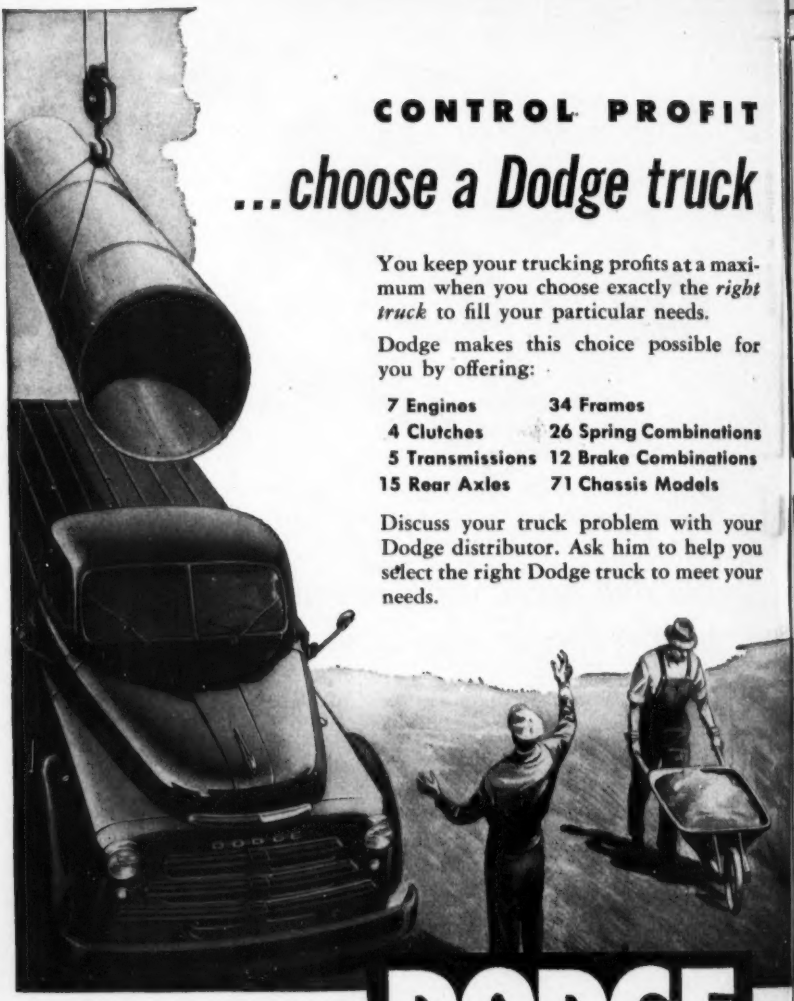

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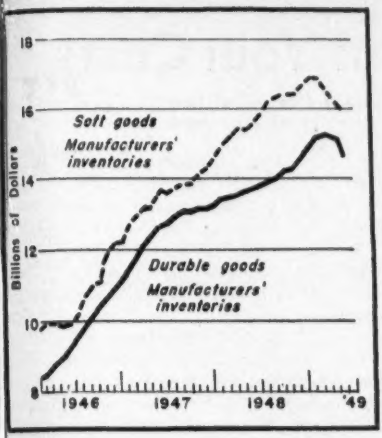
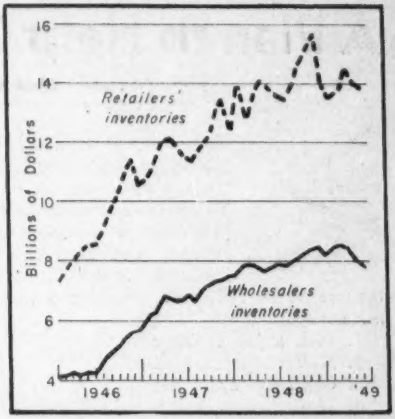




U. S. Inventories May Stabilize

Industry has been slashing inventory during 1949. Economists classify business slump as inventory recession; turn-around may come soon.

SINCE THE TURN OF THE YEAR United States industry has been cutting down on its inventory stocks. This inventory trimming has been one of the main causes of the business slump this past spring and summer.

Economists figure that in 1948 about 5% of total production was going into inventories. When business started cutting stocks, this 5% demand was eliminated. In addition, businessmen cut their orders well below the replacement level so they could work down their stocks. In all, experts believe current production is 10% lower than current sales would justify, this being the heart of the current business recession.

The big reason for the feverish inventory cutting is the fear of sudden price cuts. Businessmen are bringing their expensive inventories down to a safe level. For example, Westinghouse Electric set Sept. 1 as the date for getting its $323-million inventory at March peak down to $275-million.

When members of the Purchasing Agents Association were polled recently, 57% said they were ordering only 30 days ahead. This is generally true throughout industry. Also true is that inventories at end of July were considerably smaller than 2 months before.

Present developments, however, yield three important reasons pointing to a turn-around of the inventory recession.

(1) Inventories have pretty well completed the trimming process.

(2) The main reason for inventory cutting is gradually being removed—prices are becoming steadier as a result of wage settlements and government support on raw materials.

(3) Because production is below what sales justify, inventory stocks may soon be on the upswing.—Business Wk, July 16, p19

How To Cut Costs

A Plan to Help Cut Your Costs

Five-point program makes wide use of flow process chart. Char tends to restrict field of work; avoids unnecessary wor

MANAGEMENT'S primary job is to know exactly what it wants men to do. To make a cost-cutting program a permanent success, not merely of temporary value, a pattern must be followed. Here is a successful one:

1. Pick a job to improve.
2. Make a process chart.
3. Challenge every detail.
4. Work out a better method.
5. Apply the new method.

Pick a Job to Improve

Those jobs in the plant that need improvement are not always apparent; they must be sought out. Look for bottleneck jobs. Look for jobs that take too much time. Look for jobs where costs are high, where savings can be made.

Make a Process Chart

To analyze a job properly it must be recorded in detail. Moving pictures are good, but they are expensive.

The economical way to record operations in detail is to break down the job into chart form. Three types of charts are available: flow process charts, to emphasize distance; multiple activity charts, to emphasize time; operator process charts, to emphasize individual motions of person performing job.

The flow process chart is the simplest of the three. Data for the chart is obtained by following men, materials, and paper forms through an entire process.

To make a flow process chart:

1. State the activity being studied. Job must be broken down completely.
2. Choose one subject to follow.
3. Pick a starting point. This re stricts the area you will check.
4. Write a description of each detail step by step. No step can be omitte regardless how small that step is, how seemingly unnecessary it is. Every operation, move, storage, and inspection must be noted.
5. Apply proper symbols.
6. Black in the *do* operations. Each step is made up of *make ready*, *do*, and *put away*. *Make ready* is the effort and time put into setting up the equipment or machines or getting materials. *Do* is the actual work done. *Put away* is the clean-up following the *do*.
7. Enter distances, usually shown in feet.
8. Summarize the operation. This is merely the addition of the operations, transports, storages, and inspections and entering these totals in the summary blank on the chart. This tells the whole story to management.

Challenge Every Detail

If lasting improvement is to be made in the process, every detail of the job must be questioned as to the what, where, when, who, and how.

What—What is done? What is the purpose of doing it? Why is it done? These will determine the value of the particular detail being studied. It will tell you if the procedure is doing what it is supposed to do.

Where—Where is it done? Where is the best place to do it? Why should it be done there? Where else could it be done?

When—When is it done? When is it best to do it? Why should it be done then? If the operation is necessary, it

ust be done at the proper time. Can be done at the same time as another eration?

Who—Who does the detail? Who ould do it? Why should he do it? Can person with lesser skills do the job? ork is efficient only if the right person doing the job.

How—How is the detail performed? hy is it done that way? Can we make easier and safer?

Work Out a Better Method

After you have answered the above estions to your satisfaction, ask these estions:—Can we eliminate? Can we mbine? Can we change the sequence? an we change the place? Can we change e person? Can we improve?

The elimination question is always ard to answer. The job may have been one for many months or years. The erson doing the job is a poor one to k whether the job can or cannot be minated. An outsider's views are im-ortant. The chart helps to give you the utsider's" view.

Every handling operation should be ecked. Look for backtracking work, avy lifting or carrying, trucking, bot-enecks, skilled operators taking time r materials handling.

If no change in sequence, place, or per-on can be made, ask the final question can we improve? Unfortunately this where too many method improvements gin. And by doing so, management makes a serious error. By merely chang-g a few operations or installing a little ew equipment, all the bad features f the old method are transferred to the ew method.

Apply the New Method

Before ordering a change in methods, he new method must be thoroughly hecked. Supervisors and employees hould be consulted to see that nothing has been overlooked.

Cost of installing the new method must be weighed against any saving that might result from that new method. Since new equipment is costly, every effort should be made to utilize better existing equipment.

When the plan is in the best possible form, it should be presented in a clear, concise manner to employees. Benefits to be derived must be explained. Comparison of old and new flow process charts will be an aid in explaining benefits.

Finally, make sure the credit for the new method goes to the man or men deserving. This is a basic rule in all employee relations. It will help the new method reduce your cost.—Factory, July, p66

Flow Process Chart

PROCESS ANALYSIS CHART

SUBJECT	HEATER CORD CONNECTOR ASSEMBLY		
LOCATION	Punch Press Dept.	ANALYSIS NO.	1
DETAILS	Assemble AP-222 Brass Part AP-223 Steel Part and Brass Screw	METHOD: PRESENT	PROPOSED
SHEET	1 OF 1	BY G. Hill	DATE 4-13-49

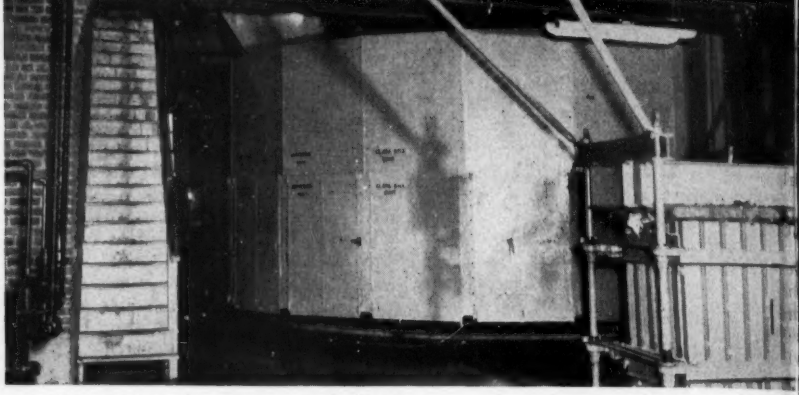
SYMBOLS: ○ OPERATION ⇨ MOVE ▽ STORAGE □ INSPECTION

TIME	TRAVEL IN FT.	SYMBOL	STEP NO.	DESCRIPTION
			AP-223 AP-223	
		○		1. Assemble AP-223 & 223 on #1/2 Toledo Federal press. Drop delivery, small tote pans.
		□		2. Process inspection of spring tension.
	8	⇨		3. To tapping machine. Carried by operator.
		○		4. Tap #5x40 machine thread. Loaded in small tote pans.
		□		5. Process inspection of machine thread.
Mach. Screw	40	⇨		6. To screw assembly machine by operator.
		○		7. Assemble screw. Drop delivery in small tote pans.
		□		8. Process inspection for loose screws.
	40	⇨		9. To temporary storage area by general man.
		▽		10. Temporary. Accumulate for large tote pan quantity.
		○		11. Dumped in large tote pan by general man.
		□		12. Weight count for billing.
		○		13. Final inspection.
		⇨		14. Load tote pans on 4-wheel truck.
	273	⇨		15. To stores dept. Truck pushed by general man.
		▽		16. Permanent until requisitioned.

SUMMARY

○ - 5 ⇨ - 3 ▽ - 4 □ - 5

Travel in feet - 361



TWENTY-FOUR BINS hold textile wastes as . . .

Carousel Eases Waste-Handling

Merry-go-round waste container handles all production wastes from three manufacturing plants. Vacuum delivery system used

WASTE-CAROUSEL · used at Gastonia Combed Yarn Corp. handles waste from three manufacturing plants. Waste-handling costs have been cut; waste-removal crews have been reduced; waste-control is more efficient; plant is cleaner.

Carousel is about 30 ft. in dia. and 10 ft. high. It contains 24 pie-shaped bins, 4 ft. wide at arc and 7½ ft. deep. Each bin holds a different type of waste; waste from each plant is kept separate from that from other plants. Each bin holds at least enough waste for a 500-lb. bale. Total carousel capacity is 10 tons.

Waste house, centrally located among the three plants, houses the carousel. Waste is piped by vacuum system to bins on a balcony above the carousel.

Delivery of waste by type and building is on a strict schedule, 25 min. being allowed to complete delivery of each type of waste. If waste does not enter delivery system during scheduled period, it must be hand-hauled to waste house.

When temporary storage bins on balcony are filled, carousel operator centers the proper carousel bin below the storage bin. Carousel's position is push-button controlled. When carousel bin is in position, waste is "swept" into carousel bin.

When the carousel bin is filled, carousel is positioned so that full bin is opposite baling station. Baling is by standard method.

Carousel is powered by a 5-hp. motor which belt-drives a gear-reduction box with a 165–1 ratio. Carousel is really a structural-steel turntable resting on eight wheels. Wheels ride on a 8-in. steel track.

Gastonia reports total saving since adoption of the new waste-handling system to be several thousand dollars. The central waste house has replaced three previously used. Waste reduction has resulted; waste control is simpler.

About 2;000 sq. ft. of storage area

s been released for production use. ekly baled waste averages 105 bales. longer do waste trucks move about plants during working hours. Two n can handle all the waste during main shift.

The "merry-go-round" has cut Gaia's production costs.—Textile World, ly, p100

amera Checks Well Casing

velopment of a camera that will take otographs of well casing brings a new d unique tool to aid in the study of ld production problems. The camera ill take pictures in dry wells, under seous conditions, and under water. An tempt will soon be made to take picres of casing in a well filled with mud nd oil. The plan is temporarily to disace the mud and oil with a slug of ater at the time of film exposure.

Operating limits for the camera are imed to be 4,500 psi. and better than 0°F. This would permit taking picres at 8,000 ft. in a water-filled well. roblems of condensation, lens fogging, nd illumination have been solved.

Photographs show the well casing to cale. With measurements taken from he prints and with casing thickness nown, it is possible to determine whether eformed portions of the casing can be orced back into position.—Oil & Gas J, uly 14, p88

"Wireless" Telephones Aid Steel Production and Safety

Several steel plants in the U. S. are improving operating efficiency and safety by installing special two-way communication between fixed stations or operators of moving machinery. Permanent telephone wiring is not needed with this "wireless" telephone made by Farmers Engrg. & Mfg. Co.

Known as Femco Trolleyphone, the instrument works by use of frequency modulated carrier current and derives its energy from trolley wires or plant power line. It is necessary only to hook the Trolleyphone to the dc. power line at a point where the phone is desired. All phones hooked into the same circuit are in direct communication.

First employed in coal mines, the system now is finding applications on soaking-pit cranes, electric-furnace cranes, ore bridges, transfer cars, coke-oven pushers, and hot cars.

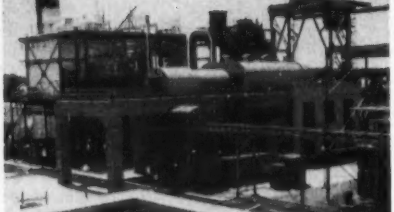
International Harvester Co., for example, is using two such systems in its Wisconsin Steel Works—one on soaking-pit cranes, the other on ore bridges and transfer cars. The control pit for the blooming-mill ingot buggy is so located that the operator can see whether ingots are delivered at the proper rate. He can talk directly with cranemen and steel recorder.—Steel, July 18, p86

How To Cut Costs

This Issue Of The Digest Brings You . . .

. . . on page 53 that promised report to management, "Better Product Design Means Lower Costs, Higher Quality." Also, see pages 20 and 46 for articles covering two other phases of cost cutting.

Next month we'll tell you how to use the electrical equipment in your plant to best advantage. And in January 1950, your Digest will have that 24-page reader bonus on cost reduction covering all branches of industry.—The Editors



OUTDOOR generating station yields a . . .

Saving Approaching $10 per Kw. because of Design

The type of outdoor generating station design, typified by the 43,750-kw. single-unit New Handley Station of the Texas Electric Service Co., clearly represents the most progressive step to date in the simplification of steam stations.

Not only the boilers, but also the generator, condenser, fans, and other auxiliaries, are in the open.

Station "building" measures only 40x60 ft. It accommodates, at mezzanine level, the central control room, which houses the main electrical switchboard as well as boiler and turbine gage boards.

Boiler feed and other auxiliary pumps, toilet, and miscellaneous features are below at finished yard grade, atop the foundation mat. Canopy-type weather protection is provided for the boiler firing aisle, while the turbine has a separate removable housing to expose the unit for inspection and maintenance.

By these and additional coordinated simplifications of equipment and piping, a saving approaching $10 per kw. was achieved—as against the cost of a conventional fully-housed plant.—Elec World, June 18, p65

Cast-Steel Static Properties

Research at National Malleable & Steel Castings Co. has shown that if any one tensile property of cast steel is given, none of the others is subject to much variation by the foundryman.

It is well known that Brinell hardness furnishes a quite accurate measure of its tensile strength. Elongation and tensile strength also have a straightline relationship (as plotted)—actually, two lines with one for normalized and tempered steels, the other for quenched and tempered steel.

Reduction of area also has a definite relationship to tensile strength, as has the yield strength. All these relationships can be expressed in terms of empirical equations, although no claim is made that every heat will conform to such relations. —Foundry, July, p70

Plastic Spray Dispenser

Dispenser mechanism of Bridgeport Brass Co.'s line of aerosol-dispensed liquid sprays is made of polyethylene and nylon parts (see McG-H Digest, June, p26). Liquid is packaged in steel crown cans combined with Freon, creating a pressure at room temperature. Plastic dispensing valve is operated by thumb pressure at rim of nozzle. A 1/16-in. displacement permits liquid to pass through a metal tube and out nozzle.—Mod Plastics, July, p67

Non-Lubricated Rolls Save

Textile mills, contacted by *Textile World* in a survey on the use of frictionless, non-lubricated rolls on spinning and roving frames, report savings in cleaning and oiling costs. Yarn deviation has been reduced also. Many of the mills reported complete elimination of oil in the drafting zone by use of non-lubricated ball-bearing front rolls and by nylon-bearing back and middle rolls.

Non-lubricated rolls can mean elimination of 400,000 oilings per thousand spindles per year. They eliminate skipped or flooded bearings and stained yarn.—Textile World, July, p110

Mirrored Model Gives Slab Bending Moments

radically new stress analyzer, based on tic principles, has been developed to nd bending moments in concrete floor abs. The basic idea is to build a model the floor slab with a highly reflective ane surface, which is used to reflect the nage of a grid.

The objective is to measure angular istortions of the surface of the model nder load and then to resolve these ngular distortions into moments. This done by first photographing and then easuring spacings in the grid reflected om the strained and distorted mirrored rface of the model.

Instead of the usual indicating needles pantographs, readings are obtained ith the aid of light rays. Under these nditions, it was found possible to attain remarkable degree of accuracy.—Eng ews-Rec, July 7, p70

Wheys Have Important Uses

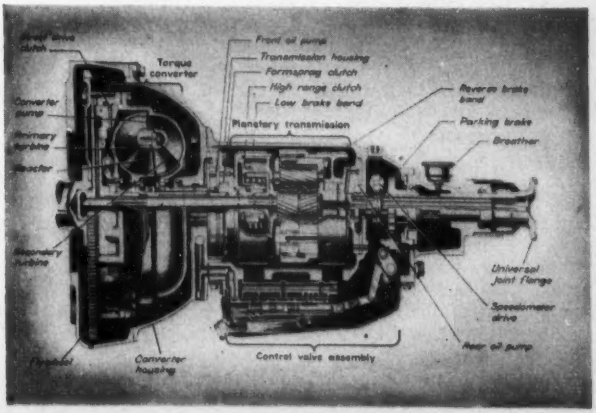
Whey from cheese and casein plants, nce discarded, can now be used as an imal feed supplement and as the starting point in the manufacture of U.S.P. lactose. By concentrating and then either tunnel, drum, or spray drying, cheese and casein whey can be converted into a useful powder.

Whey contains milk-sugar protein in the form of milk minerals and vitamins. It can be processed to recover the milk-sugar content in the form of U.S.P. lactose.

Fermentation of whey offers another means of processing; lactic, butyric, and ethyl fermentations are practiced on a commercial scale. In the lactic fermentation, calcium albuminate is produced as a byproduct, for subsequent use in producing animal feed.—Food Ind, July, p54

Refinishes Worn Shuttles

Worn shuttles can be refinished and sized simultaneously with accuracy on a new machine developed by Machine Design Products, Inc. Shuttle tip is held by carrier so that tip is always in line with sanding surface. Shuttles can be held flat against back plate for side and bottom finishing or held away from plate for corner finishing.—Textile World, July, p141



SHOW PACKARD'S ULTRAMATIC DRIVE

Schematic diagram shows construction of Packard's "Ultramatic Drive" (See McG-H Digest, July, p57). Torque converter in the automatic transmission is intended only for acceleration. At cruising speeds, direct drive clutch completes a mechanical connection between engine and rear wheels. —Prod Eng, July, p90

Capital Expenditures Big; Slip Slightly from Last Year

Total capital expenditures by U. S. industry during the third quarter of 1949 will be off about 4% from the second-quarter figure of this year as well as the third-quarter figure for 1948. But the expenditure for expansion and new equipment—$4,630,000,000—is still large enough to put a substantial prop under national income and employment.

Third-quarter expenditures are actually a little greater than predicted last spring. The U. S. Dept. of Commerce expected a second-half drop to carry the 1949 total expenditures to a point roughly 14% below the 1948 total.

By industrial groups, estimated expenditures are as follows for third-quarter 1949 compared with actual expenditures for 1948, in millions of dollars:

	1948	1949
Manufacturing	2,090	1,840
Mining	200	190
Railroads	320	310
Other Transport	170	170
Utilities	690	830
Commercial & Misc...	1,360	1,290
Totals	4,830	4,630

Should 1949 follow the pattern set in previous years, there should be a seasonal up swing in the final quarter of this year.—Business Wk, July 9, p21

Less Ignition Interference

Relief for communication services that suffer from ignition interference is promised by future use of resistor-type spark plugs on automobiles. Effect is to dampen high-voltage peaks in capacitance phase of the spark.

Research by Electric Auto-Lite Co. has shown that wider gap settings can increase effectiveness of spark discharge and make starting easier. Previously, it was commonly thought that resistor plugs would adversely affect starting.

The Auto-Lite resistor plug incorporates a 10,000-ohm resistor. This results in a substantial reduction in electrode erosion. The reduced gap erosion also helps to eliminate any detrimental effect on starting. After use, required voltage of resistor plugs is usually less than that for non-resistor plugs.—Electronics, July, p118

Casts Milling Cutters

Prompt delivery of milling-machine cutters was impossible during the war. The solution for the Watervliet Arsenal was to precision-cast cutters from tool scrap.

Molds are made as in other investment molding. Then scrap toolbit inserts from large circular mills are melted in an induction furnace. Chemical analysis is 0.76 C, 4.84 Cr, 0.10 Mo, 17.2 W, and 1.55 V—about that of 18-4-2 tool steel.

Results of machining tests indicate that performance of cast cutters is superior to that of forged cutters. Test cutters were 3 in. in dia. and 5/16 in. wide. Run at 35 rpm., 1-in. feed and ¼-in. cut depth, two cast cutters gave 63 and 73.7 ft. for length of cut before dulling, as compared to 49 ft. for a forged cutter.

Other results at different feeds and cut depths included 85.5 and 94.5 ft. against 58.5 ft., and 85.5 and 74.9 ft. against 21.3 ft.—Am Mach, July 14, p89

Alcohol-Yeast Process

Bakers' yeast production in commercial quantities under the "Deloffre Alcohol Process" is attracting food industry attention in Australia.

A highly concentrated sugar solution is inoculated with a small culture of pure yeast, which is then fermented to produce a maximum quantity of alcohol. The alcohol is used to form yeast under conditions that permit the yeast to absorb the alcohol.—Food Ind, July, p113

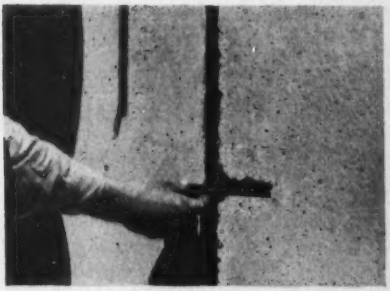
1 Aluminum exterior panels are placed by hand, bolted to steel frame.

2 "Diacreite" (cement-diatomaceous-earth) back provides insulation.

All-Aluminum Office Building

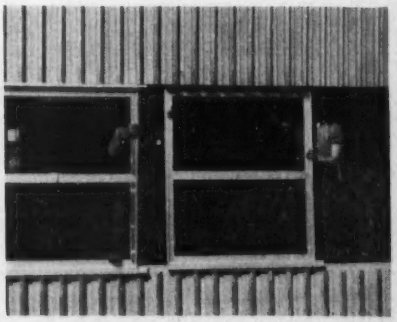
Looking toward greater use of aluminum in buildings, Aluminum Co. of America sets example with aluminum office building.—Business Wk, July 9, p42

3 Open joints are troweled with cement before final finishing.

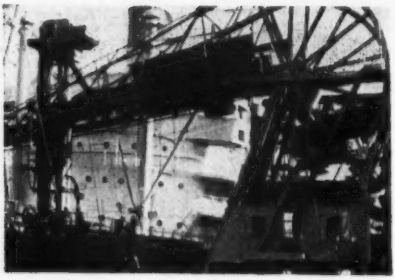


4 Simultaneously, panels are joined by bolts in slots, then cemented.

5 Foil serves as moisture seal. After smoothing, plaster is applied.



6 Windows, with aluminum frames, slide into place between aluminum panels.



BULK HANDLE HAWAIIAN SUGAR

Almost 50% of Hawaiian sugar is now shipped to refineries in bulk form rather than in 100-lb. burlap bags. Arriving in California shipyard, sugar is bucket-unloaded and belt-conveyed to storage. Belt conveyor shown is mounted on gantries and can be moved along dock to various hatches.—Food Ind, July, p64

Prefab Warm-Air System For New or Old Houses

Savings up to $100 per house, new or old, are claimed for Coleman Co.'s prefabricated warm-air heating system. Entire system, including oil- or gas-fired furnace and plenum chamber, arrives packaged. Using special clamps to hold pipes together, the system can be installed in a 5-room house in a day.

Ducting is factory-made, sheet-metal tubing 3½ in. dia. In standard warm-air system the hand-made ducts represent 50-75% of the system's cost. Tubes fit inside standard walls. There is no rush of warm air into the room from the small ducts. At the end of each duct a nozzle opens into a metal cabinet, the cabinet serving as a mixing chamber. Mixed with cool air in the grilled-chamber, warm-air speed is reduced to 300 fpm.

Grills at both top and bottom of the mixing cabinet provide good air circulation. Units are designed for amusement or utility room installation.—Business Wk, July 9, p48

Substation Power Increased Through Use of Refrigeration

Control of ambient temperature by refrigeration has made the building of several new substations of the Philadelphia Electric Co. unnecessary. Refrigeration has made it possible to apply 60% higher ratings (from 22,500 to 36,000 kva.) to existing distribution circuits of which load has outgrown original capacities.

Refrigeration equipment to maintain a low ambient temperature was installed in each individual distribution circuit. In the original design, four 7,500-kva. transformer banks operated with an effective ambient temperature of 25°C. in winter and 30°C. in summer.

By taking advantage of the margin below 40°C. in the ambient temperature it was possible to apply ratings of 9,000 kva. to the temperature banks. Capacity of supply lines was increased by adding a second cable in parallel with the existing one.—Elec World, July 16, p71

Thermoplastic Mold Powder

A new styrene-based copolymer thermoplastic molding material, called Plexene TA, has impact strength in the high cellulosic range. Plexene TA moldings have outstanding dimensional stability resulting from low water absorption and absence of plasticizers; good chemical and electrical properties; and good moldability because of low flow temperature.

For injection molding, pressures should be high and dies hot—130 to 170° F. Press ram should be forward about two-thirds of the time mold is closed. The material is handled easily by standard extrusion equipment. Its surface approximates a matte finish. Buffing or solvent treatment gives a high gloss.

Plexene TA can be compression-molded in positive or semi-positive molds. The powder is available in black and opaque colors.—Mod Plastics, July, p68

atty-Acid Plant Features igh-Pressure Hydrolysis

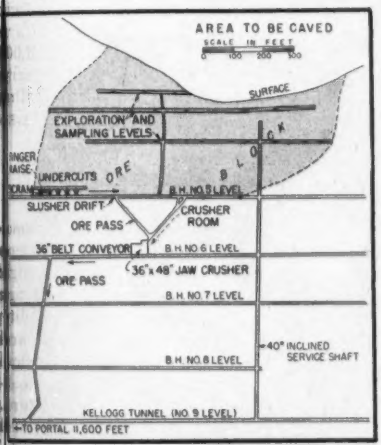
eneral Mills, in a new Foster-Wheeler-signed plant, is producing 30-million per year of fatty-acid products from a riety of different natural oils. First eration is the hydrolysis of oils to fatty ids, either in a continuous column or in witchell hydrolysis units.

Resulting fatty acids and water glycer-e mixture is separated by the fference in specific gravities. The water-ycerine mixture is concentrated by eva-oration to recover glycerine.

The fatty-acid product is separated to several cuts in a series of three ntinuous distillation columns. These olumns operate under high vacuum and must be heated by Dowtherm condensers to reach the high temperature involved.

Some fatty-acid products receive further processing. One is hydrogenation of unsaturated bonds in the acid chain. This is performed batchwise in a pair of high-pressure converters.

Either hydrogenated or unhydrogenated fatty acid may be roasted in an esterification unit to produce drying oils. Polyhydric alcohol is added and the water formed in the reaction is distilled off, leaving the finished oil.—Chem Eng, July, p92, 128



RECOVER LOW-GRADE ORE

Bunker Hill's new block-caving project for recovery of low-grade ore will gradually keep the mill up to capacity by replacing reclaimed jig tailings. Development work for block caving is shown. Ore will be caved by means of undercuts through finger raises. From the scram drifts, ore will be scraped to ore pass leading to an underground crusher room, and then belt-conveyed to the main haulage level.—Eng & Min J, July, p110

Reports Shop Cost Reduction

At the recent annual meeting of the National Industrial Service Association, a successful cost-reduction program for an electrical service shop was reported by Illinois Electric Works, Inc. Heart of the program is a table of average material cost figures for motors up to 25 hp. in size.

These figures are based on detailed cost data collected over years of experience. They include all material used in rewinding stators as well as varnish and baking costs. Results over 4 yr. of use are a 50% reduction in office material costing time and a considerable saving in mechanic's time.—Elec C&M, July, p221

Waterproof Ignition

Chrysler Corp. is now waterproofing ignition systems on its automobiles. Spark-plug covers, comprising a steel bowl and flexible neoprene cap for the terminal end, protect insulators from splashed water and keep them free of oil and dirt.

Spark-plug wiring is neoprene-covered to render it waterproof. Braided wiring, which absorbs moisture, is eliminated. Vinylite caps seal the connections of ignition cables to the coil and distributor cap towers.—Steel, July 18, p67

How Oil Is Made From Coal

Full development of the new oil-from-coal industry considered imperative because of possible huge demand in case of national emergency in the U. S.

BOLDEST advance toward a commercial synthetic-liquid-fuels industry in the United States was the recent dedication of two coal-to-oil demonstration plants at Louisiana, Mo.—a $10-million hydrogenation plant to produce 200-300 bbl. of liquid fuel each day and a $5-million gas-synthesis plant to turn out 80-100 bbl. per day of motor gasoline and diesel fuel.

From the standpoint of reserves and accessibility, coal is in a more favorable position than any other natural resource to provide raw materials for a large synthetic-fuel industry.

Big difference between coal and crude petroleum is that petroleum contains about twice as much hydrogen. By adding hydrogen and rearranging the structure of hydrogen and carbon molecules, coal can be converted to oil under proper conditions of pressure and temperature and with the help of certain catalysts. Two basic processes bring about this change: (1) indirect conversion by gas synthesis and (2) direct hydrogenation.

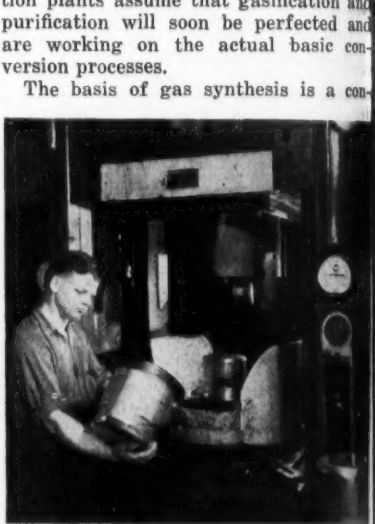
For both processes, the coal first has to be dried. Comprehensive trials of two drying methods have produced the following results: (1) removal of over 90% of bed moisture; (2) a boost in heating value of sub-bituminous by 25% and of lignite by 45%; and (3) weight reduction equal to 90% of weight of moisture removed.

The real problem is coal gasification. Some 60-70% of the cost of gas synthesis is chargeable to making synthesis gas and 30-50% of hydrogenation costs are chargeable to compressed hydrogen gas required.

Three methods for direct gasification of high-rank bituminous, eliminating the coke-making stage, are being investigated. They are (1) a vortex gas generator; (2) underground gasification and (3) a continuous high-temperature pebble-stone gasifier. The Bureau of Mines is also experimenting on ways to make gas from sub-bituminous coals and lignites.

No matter which process is used for gasification, the gas must be cleaned and purified afterwards. Bureau engineers at the gas-synthesis and coal-hydrogenation plants assume that gasification and purification will soon be perfected and are working on the actual basic conversion processes.

The basis of gas synthesis is a con-

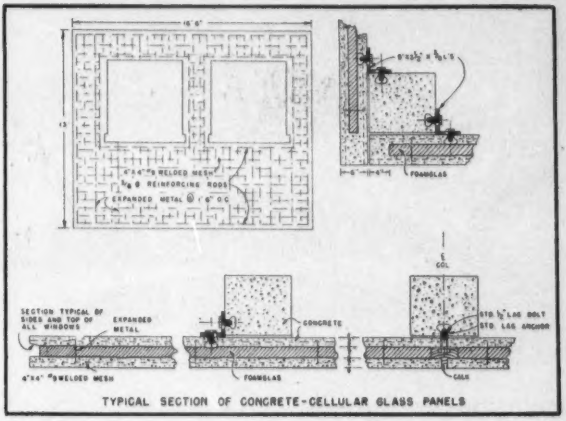


HYDRAULIC DIE BULGES POTS

Hotpoint electric range has an aluminum-alloy cooker shell with unsymmetrical bulged sidewall. Bulging is performed in this hydraulic die at 165 parts per hr. Double-action press has a hydraulic-pressure intensifying cylinder in its base. Water is forced into workpiece through 1-in. inlet in base of punch assembly. Open punch design permits rapid entry of the water.—Am Mach, June 30, p96

SANDWICH WALLS SAVE WEIGHT

ulated, reinforced, pre-
st concrete curtain
lls have been used ef-
tively in many indus-
ial buildings. Most
pular is 6-in. wall, 2-in.
llular glass insulation
ndwiched between 2-in.
ncrete slabs. Excess
ater is removed from
ncrete by vacuum proc-
s, and slabs are machine
owe!ed. Wall shown
eighs from 40 to 60 psf.
pending on aggregate
eight. This is one-third
e weight of typical
asonry wall. — Eng
ews-Rec, June 23, p39



TYPICAL SECTION OF CONCRETE-CELLULAR GLASS PANELS

erter. A catalytic reaction converts the
al gas into oil vapors. It is then con-
ensed and distilled to form the end
oducts. A good deal of investigation
ill must be done on various catalysts
hich determine the proportion of carbon
onoxide and hydrogen needed in the
ynthesis gas.

In hydrogenation, solid coal, heavy oil,
nd catalyst form a paste which enters
rst a series of liquid-phase separators
hich use hydrogen from coal gasifica-
on, and then a fractionating tower.
he Bureau, in an effort to reduce costs,
studying the possibility of converting
ly half the coal to liquid fuels, the
mainder going to coke breeze or gas.

Various products of hydrogenation in-
ude high-grade aviation fuel and avia-
on base stock, diesel fuel, heavy fuel
l, high Btu. jet fuel, liquid petroleum
as, and a variety of heating gases and
y-product phenol, xylenols, and cresols.

Gas synthesis produces a range of 70
o 90% motor gasoline, plus lower Btu.
et fuel and liquid petroleum gas.

Thus, the processes are complemen-
ary, rather than competitive. Full de-
velopment of each will create a well
rounded synthetic-liquid-fuels industry.
—Coal Age, July, p70

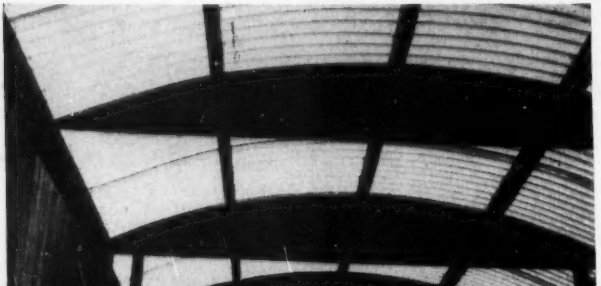
Drills Thin Glass with Phosphor-Bronze Tube Drill

Drilling holes in 3/32-in. thick sheets of glass results in cracking and fracture with customary drilling methods. A successful method developed in England employs a hardwood block secured to the machine table. Four mild-steel strips of 3/32-in. thickness were screwed to the top of the block, forming a nest for the glass.

The drill is a length of phosphor-bronze tube with outside diameter about 0.005 in. less than desired hole diameter. Tube bore is 9/16 in. The end face of the tube drill was turned true, and six shallow serrations, equally spaced and 0.025 in. deep, were filed across the end of the drill.

With the glass nested on the block, a clay dam is built around the hole point. The drill is set to run accurately in its chuck. Carborundum paste is tamped in the bore of the drill as well as smeared on the glass.

Drilling is then done at 12-20 rpm. To insure a steady pressure on the drill, a 2-lb. weight is attached to the feed lever. —Mach, June 25, p329



LIGHT ROOF

Translucent corrugated sheeting, made of Fiberglas mat impregnated with Laminac resin, means a well lit plant when used for roof, skylight, or windows. The material which is manufactured by Allied Synthetic Co., can be sawed and nailed easily. Sheets are flat or curved as here shown.—Foundry, July, p192

Isolation of Pure Metallic Zirconium Nearly Complete

Research of U. S. Bureau of Mines on pure metallic zirconium has shown its strength at moderate temperatures (below 900° F.) is even better than the average stainless steel. Tensile strength for cold-worked zirconium is 115,000 to 140,000 psi.; annealed strength varies from 42,000 to 70,000 psi.; and yield strength is 80,000 to 12,000 psi. cold worked, 30,000 psi. annealed.

At present, the metal has been brought to 97 to 98½% purity, the impurity being the rare metal hafnium. Once a way is devised to separate the two metals, a completely new set of characteristics may be found for absolutely pure zirconium.

Although sponge zirconium now costs about $30 a pound, price is expected to be halved shortly when a new system of refining the ore goes in the line at the Bureau's pilot plant.—Prod Eng, July, p153

Rechargeable Silver-Zinc Cell

First rechargeable silver-zinc cell, using an alkaline electrolyte, may find use as an aircraft battery element. Cell weighs only 25% as much as lead cell of equivalent rating. The manufacturer claims weight and space savings offset slightly higher cost.

Other claims: electrolyte is absorbed, not driven off; no corrosive acid fumes; no leakage; added mechanical strength and resistance to shock and vibration.—Aviation Wk, July 4, p30

Install Vacuum-Tube Relays

California Hawaiian Sugar Refining Corp. has adopted the vacuum-tube relay system for control of its 650 motors. The plant has a 2-phase, 515-volt system and a conventional 3-phase, 440-volt system with most motors in 3 phase.

Motors previously interlocked in starting and stopping sequence by tying in 440-volt relay to run side of leading motor contactor. This resulted in a high-resistance contact which ran between 200 and 1,000 ohms.

Solution to this was conversion to high-impedance circuits, which meant electronic vacuum-tube relays. Advantages are (1) use of single wire; (2) circuit in order of microvolts, thereby resulting in no sparking at pushbutton contacts; (4) fire hazard reduced; (5) maintenance reduced to insulation-resistance test; (6) no problem of high-resistance contactor. —Power, July, p95

Portable Seismograph Cuts Bedrock Drilling, Saves Time

Portable refraction seismograph is being used by Wesley, Bedford, & Stickle, consulting geographical engineers, to check depth of bedrock and foundation composition for heavy construction projects. Use of drill holes is thus made unnecessary. Seismograph surveys can eliminate 75% of previously necessary drilling. Only "double-checking" drills will be necessary to prove accuracy of the seismographic test.

Seismograph will result in lower construction costs (drilling costs three times as much as seismography) and will do survey faster.

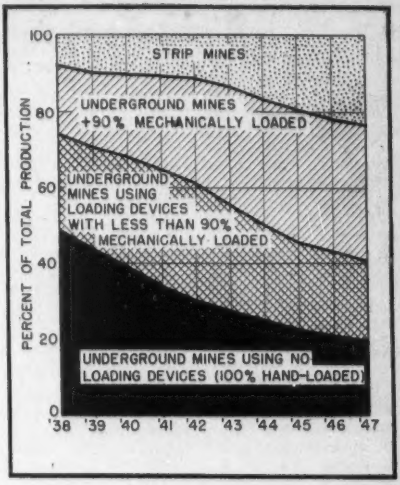
Small dynamite charge is placed 5 ft. below ground. Detecting units are placed at intervals in a straight line on the surface and are connected to the seismograph. When charge is detonated, detecting units transmit impulses back to seismograph. Impulses are recorded on photographic paper, calibrated in hundredths of a second.—Business Wk, July 2, p44

Treats Plating-Mill Waste

New treatment plant for plating-mill waste, built near Philadelphia for Milford Rivet and Machine Co., is noteworthy because of its simplicity and flexibility.

Wastes from cleaning, degreasing, and tumbling barrels are treated with sulphuric acid and air to crack the oil, which is then drawn off. Remaining waste flows to batch-type chemical treatment tanks. Here it is mixed with cyanide and plating wastes.

Calcium hypochlorite is added to give a chlorine residual of 15 ppm. After 15 min. of agitation, sulphuric acid is added to effect coagulation. Treated batch is allowed to settle 8–16 hr. Clear liquid is drawn off, and sludge is pumped to a receiving lagoon.—Iron Age, July 14, p105



COAL-MINE MECHANIZATION

Figures compiled by the U. S. Bureau of Mines show an increase from 50% to nearly 80% in the amount of bituminous coal mined mechanically or by strip methods in the U. S. from 1938 to 1947. Of the 1947 total tonnage, 23.8% was produced by 170 mines using mechanical loading. In the 500,000-tons-per-yr. and over mines, 57% of the total was deep-mined in mechanized workings. Less than 5% of the output was hand-mined.—Coal Age, June, p98

Expands Chemical Production

The British dollar shortage will be aided by a $2½-million reduction in chemical imports when the Monsanto Chemicals Ltd.'s plants in North and South Wales get into full production.

Production levels first set have in some cases been doubled or trebled in latest expansion plan. New products to be made include a vanadium catalyst for sulphuric-acid plants, diphenyl and derivatives for electrical industries, silicon chemicals, polystyrene and specialty plasticizers, and synthetic adhesives.—Chem Eng, July, p213

Technical Shorts

Split Ailerons on XF-89—Fullspan flaps will be used on the XF-89 all-weather fighter. Wing thinness prevented use of spoiler ailerons. In flight, surfaces function as conventional ailerons with lower portion providing flap action. They can be used as maneuvering or dive flaps.—Aviation Wk, July 4, p18

Welds by Capacitance Heating—No discoloration, flash, or fillet is produced on plated metal surfaces when stud welding by new capacitance heating method. As current does not pass through metal sheet, no fillet or "burned" spot is formed.—Prod Eng, July, p5

Preventing Slag Deposits—Laboratory studies have indicated that a lime-slurry coating will prevent objectionable deposits on superheater and economizer tubes. It acts by retarding formation of sulfur trioxide (SO_3) in boilers.—Power, July, p130

For Brighter Jewelry—Lighting engineers in designing systems for jewelry stores should remember that direct light from clear filament lamps provides sparkle and brilliance on jewelry. But silverware and other displays show up best when lighted by fluorescents.—Elec C&M, June, p62

SIMPLIFIES PAPER HOISTING

Two sections of wide belting are secured at each end to specially formed sections of bar stock and fashioned into a hoisting sling. This handles awkward rolls without the risk of their sliding out or swinging dangerously as they are transported.—Paper Ind & World, June, p371

Fractured Threads—Thread tips on stainless-steel bolts in an aircraft application have been fracturing. Reason—rolled threads were work-hardened but not stress-relieved. Manufacturer now plans to mill the threads, at greater cost but no embrittlement. Meanwhile, stainless-steel nuts with sulphur content are being tried to reduce galling with the bolt alloy which contains selenium.—Am Mach, July 14, p145

Preserves Lug Boxes—Tests made on lug boxes coated with new, low-cost resin—Colresin No. 6-108—point to longer life, more constant tare weights, and stain-free, easily cleaned surfaces. Boxes are used by fresh-fruit canners, freezers, dehydrators, and packers to transport produce from field to plant.—Food Ind, July, p71

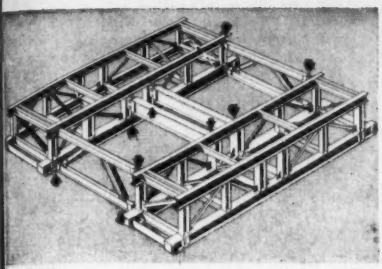
Add Rubber to Wearing Course—Small quantities of powdered natural rubber have been added to the wearing course on a 1,000-ft. section of road in Virginia to determine whether the durability and resistance to skidding on the surface can be improved.—Eng News-Rec, July 7, p52

Insulates Risers—Insulating material for sprues and risers for nonferrous castings consists of 3¾ lb. diatomaceous earth, ¾ lb. bentonite, and 1 pt. resin (made up of 160 g. phenol formaldehyde resin, 240 g. alcohol, and 2 qt. water). Mixture is molded to sleeve shape and baked.—Foundry, June, p118

Radiant Heaters—Restaurant has installed radiant heaters which keep food hot on the counter, but do not overheat plates. Two 800-w. aluminum-reflector heaters, 11 in. above food, have eliminated customer complaints about cold food.—Elec World, June 18, p106

Improved Annealing Atmosphere—A steam atmosphere does a better job of annealing nonferrous parts than does air annealing. It is less expensive than other controlled atmospheres. Preheated to 1,000° F., parts get steam treatment which produces a thin protective adherent oxide.—Prod Eng, July, p5

Electrolytic Tinning Bath—Tin Research Institute is working on an electrolytic tinning bath that has promised to provide a wider range of workable current densities than has previously been available. If successful on a commercial scale, it will aid production of tin plate with thicker coatings on existing electrolytic lines.—Iron Age, June 23, p64



STEEL BEARING PLATES

Wooden sills, matting, and blocking are entirely eliminated at derrick substructure used by Roy Guffey Drilling Co. at six of its rigs. This unitized steel substructure has integral 3½x7-ft. steel bearing plates at each corner. Entire load, whether on derrick, rotary table, or pipe rack, is carried at four corners—as far as possible away from the cellar and hole. —Oil & Gas J, June 30, p82

Farm Building Layout—Greatly increased cost of farm labor—tripled in the last 10 yr. —is changing the physical layout of farm service buildings. Correct construction and efficient layout contribute to maximum profit in investments. Other important factors are mechanization and modern farming practices. —Am Builder, July, p68

Facilitates Loading—Floating ramps facilitate loading and unloading of road trucks and trailers. Truck is backed into position and the ramp lowered to rest on the edge of the truck bed. Ramp then floats down as truck is loaded and upward as it is unloaded. —Factory, July, p140

Paraffin Repels Glaze—To prevent sprayed glaze from adhering to dishes, cups, or other ware, many potteries apply a thin film of paraffin or wax over the spots where glaze is not desirable.—Ceramic Ind, July, p78

Sampling Drill—A hollow drill made by silver-soldering carbide tips to a used piece of piston rod removes circular specimens of metal for testing purposes.—Railway Mech Eng, July, p391

Heating Aids Refrigerant Transfer—Sulfur dioxide, Freon 12, and methyl chloride can be transferred quickly from shipping drum to plant system by applying a small amount of heat. But using steam hoses, hot water, or gas fumes is dangerous. Controlled application of heat with steam coils is necessary for safety.—Oper Eng, July, p54

Develops Shaving Method—A new gear-shaving method has been developed by Power Plant Co., Ltd. Called the Finroc system, it employs a cutter consisting of a helical pinion with radial slots on both flanks. Slot edges serve as cutting edges as the cutter is rotated with gear and reciprocated. System is claimed to remove all undulations left by hobbing.—Mach, July 2, p365

Three-way Export Pack—Growing practice for American importing firms is to send corrugated shipper to exporter as a flat blank complete with collapsed corrugated dividers and lining pads. Package comes back to them as complete pack and then on to user in same form.—Mod Packaging, July, p104

Gamma-proof Paint—An Australian firm is planning to manufacture a paint that will protect against gamma rays of atomic bomb. Developed in England, the paint consists of colloidal lead suspended in linseed oil. Solid lead coating of ⅛ in. can be built up.—Chem Eng, July, p214

Studies Porcelain Enamel—Texture of porcelain enamel can be evaluated by a plastic-replica technique developed by U. S. National Bureau of Standards. Surface is covered with ethyl cellulose to form replica, which is then removed and examined by transmitted or reflected light or projected for enlargement. —Foundry, July, p118

Borehole Tests Facilitated—Mechanically operated copper air-sample bottle has solved the problem of quickly securing air samples for chemical analysis from bore holes. Use of it has materially cut the time required for an analysis report. At proper depth in the bore hole, water is allowed to run from the bottle. This draws in the air sample.—Coal Age, July, p108

Underground Radio Waves—A salt mine in Texas was the scene of a recent demonstration of radio reception from a transmitter 1,200 ft. away on the surface. The test proved definitely that waves actually travel through the earth. In mineral prospecting, both transmitter and receiver would be on the surface, and waves would be reflected from subsurface deposit.—Electronics, July, p120

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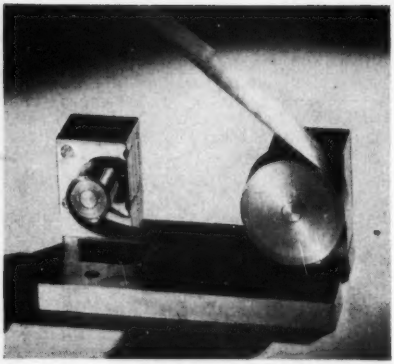


ABILITY to act around corners without inaccuracies is one use of new flat or negative gradient spring device

Negative Spring Becomes Basic New Elastic Member

Designers, who work with spring products, have long wished for the seeming impossibility of elastic members with flat or negative spring gradients, having constant or decreasing spring force with increased deflection. A new spring device with these characteristics, the "Neg'ator," has been developed by the Hunter Spring Co. and should be the answer to many constant loading mechanism problems.

This prestressed coiled component is characterized by five outstanding properties:

1. Flat or receding force-deflection characteristics.

2. Enormous expandability and range of action. Usable deflections as high as 50 times original dimensions, as contrasted to usual extension spring which expands only ½ to 2 times its original length.

3. Ability to act without inaccuracies around corners and through small openings.

4. High initial force at initial deflection.

5. Ability to store and deliver approximately twice as much energy as equivalent spiral or power spring.

Already basic fields of application for the Neg'ator have appeared. They are as a spring (extension or compression); self-adjusting clamp, clip, or wrapping; Vernier force compensator; transducer for converting energy from one system to another; automatic coiling device; friction board; telescopic tube form; and means of power or motion transmission. —Prod Eng, July, p136

Huge Diesel Plant for Mexico

What is claimed to be the largest oil-burning diesel plant in the Western Hemisphere is now operating at Tacubaya, industrial suburb of Mexico City. With six diesel-electric sets of 5,150 kw., it supplies 30,900 kw. of electric energy to the central plateau of Mexico.

Special interest is awakened because design is for Mexican fuel oil of the bunker-C class.

Six Nordberg 12-cylinder, 29x40-in., 2-cycle mechanical injection engines drive General Electric 7500-kva., 0.8-pf., 6.3-kv. generators. At rated speed, 167 rpm., each engine carries a sea-level rating of 8,650 hp. As plant is 7,500 ft. above sea level, corresponding full-load rating is 6,680 hp.—Power, July, p72

Good Vision: Good Work

Tests, using Bausch & Lomb Optical Co.'s "Ortho-Rater," at Fulton Bag & Cotton Mills show a direct relation between good vision and good work. Workers properly equipped to do the assigned job proved 22% more efficient than those with deficient vision. In the bag department efficiency was 32% greater.

Accident rate among workers with poor vision ran 39 accidents per hundred workers while only 17 per 100 among those with good vision. Attendance is 20% better in the latter group.—Textile World, July, p97

Reduce Airplane Crash Fire Hazard by Automatic Switch

Fire, aviation's greatest killer, is accountable for up to 70% of all fatalities in airplane crashes. Many fatal fires occuring after an airplane crashes can be avoided by use of a crash switch that automatically operates regular crash-fire extinguishing equipment.

Possible sources of ignition in crash fires and methods for preventing them are:

For exhaust flames from engines, the crash switch should shut off the fuel and inject extinguishant into the engine.

Hot metal parts can be dealt with by a crash-activated extinguisher spraying them with extinguishant.

The main blanket of extinguishant over the engine should maintain a dead atmosphere until rotation of damaged parts ceases.

To prevent ignition from sparking or burning of short circuits, the crash switch should isolate the emergency service batteries from the main aircraft system and cut the latter off.

Sparks from ground friction are unlikely to be a serious danger with reasonable tank installation design.—Aviation Wk, June 20, p27

Carpet Loom Improvements

Drawing of needle and knife motions and overhead mechanism by a separate automatically controlled motor is a new design feature in axminster carpet looms. Drive takes the main load on the loom-chain drive.

Automatic knock-off devices on the newer looms protect against failure of the tube from clutch arm and whiproll, dropping of tube frames, and warp and filling breaks. The stop motions are tied to an annunciater system which tells weaver the cause of loom stoppages.

Substitution of steel for wood in spools and tube frames has permitted increased spool and beam sizes. This has resulted in increased loom efficiencies and reduced waste.—Textile World, July, p125

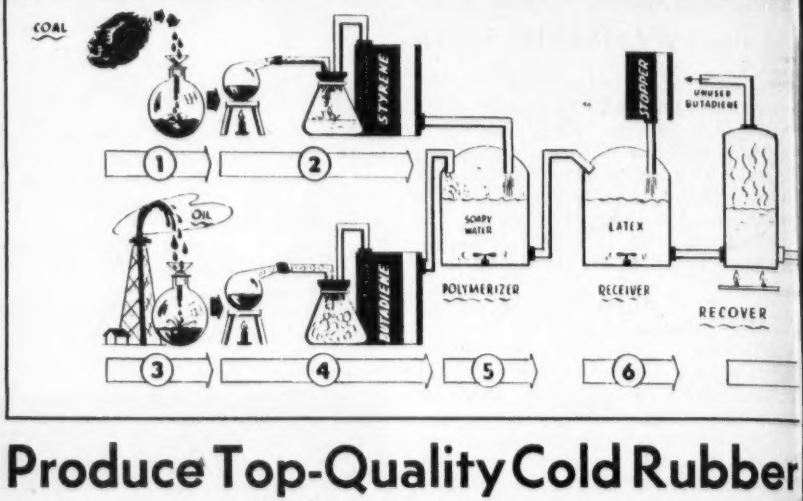
Freeze Auto Repair Parts

A 16 cu. ft. commercial-type refrigerator unit has been installed in one of Automotive Equipment's maintenance shops. Parts, such as axle load tubes, differential gears, and all pressed type cylinder sleeves, are kept in the refrigerator for shrinkage purposes. Temperature is 20° F. below zero.

Shrinking process saves time and damage when installing shrunk parts.—Bus Trans, July, p57

TO STUDY VANISHING GASES

U. S. National Bureau of Standards, in studying disappearance of tube filler gases or "clean-up," uses this special helium-filled arc discharge tube. It contains a replaceable tantalum probe wire at the center to collect positive ions. Rate of gas clean-up is measured for various negative dc. potentials on probe in presence of arc discharge. —Electronics, July, p160



Produce Top-Quality Cold Rubber

Converted synthetic-rubber plant with capacity of 60-million lb. polymerizes butadiene and styrene at 41° F. to produce new top-quality product

FIRST PLANT to convert 100% to the production of "cold rubber"—the new synthetic which exceeds the quality of the best natural rubber—has just been put into full operation. Eight companies, operating as Copolymer Corp., run this 60-million lb. annual capacity plant for Rubber Reserve Co., an agency of Reconstruction Finance Corp.

So named because it polymerizes at 41° F. as compared with 122° F. for GR-S synthetic rubber, cold rubber costs the same to produce as the GR-S type and no more to process through the tire plants. Copolymer claims that cold-rubber tires are longer wearing, and that if replacement passenger tires in 1948 had been made with cold-rubber tread, American motorists would have saved over $205-million in that year.

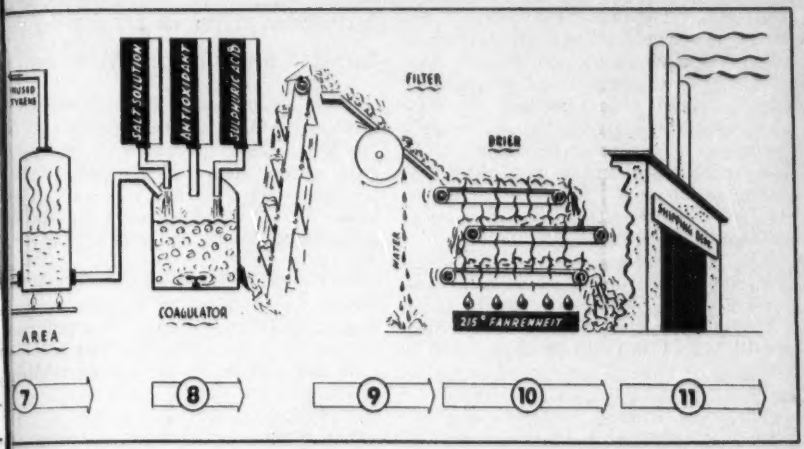
The illustrations above are a graphic presentation of the manufacture of cold rubber at the Copolymer plant.

Butadiene and styrene, the principal ingredients, are stored at the tank farm and blended with recycle material from the recovery units.

Small amounts of activator and catalyst solution are added to speed the butadiene-styrene copolymerization reaction in the soapy water. A modifier to control toughness of the finished product is also added in this phase. The batch temperature in the polymerizer is kept low by circulating coolant through the reactor jacket.

When the batch is finished, it is pumped to the receiver or blowdown, where shortstop solution is added to the latex. Latex is then heated with live steam.

Latex from the receiver is fed continuously to the recovery flash tanks in which the excess butadiene is vaporized at reduced pressures. Butadiene vapors are compressed, liquefied, and returned to the tank farm for blending. The excess styrene is then removed in the columns



by steam stripping under vacuum. Styrene and steam are condensed and separated, and the recycle styrene is also returned to the tank farm.

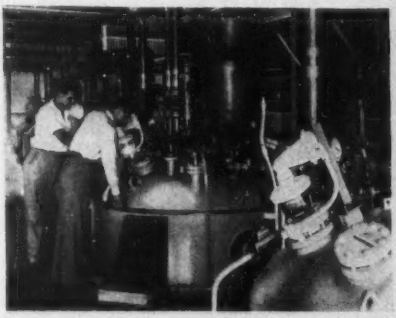
Measured quantities of latex, anti-oxidant, brine, and dilute acid are mixed in the coagulation pumps, causing the rubber to separate from the latex. Rubber crumb is screened to remove the serum and washed on a rotary filter. It is then shredded in a hammer mill and blown to a dryer. Dry rubber is compressed into 75-lb. bales, dusted, and packed in paper bags for shipment.

In the plant's early commercial production of cold rubber, some of the difficulties encountered were: (1) lack of powerful shortstopping agents; (2) tendency for rubber to precoagulate in reactors, pumps, and lines; (3) oxygen contamination; and (4) lack of suitable control methods for a polymerization 24 times as active as GR-S.

In all, it took nearly a year before it was possible to operate with assurance, heat the latex without precoagulation, and control quality to narrow variations.

Commercial production of cold rubber, which began at the plant in February, 1948, is a recent development. For a long time, authorities suggested that ideal polymerization temperature would be the tropical temperature at which natural rubber is formed. However, in April, 1947, Phillips Petroleum Co.'s pilot plant, engaged in a low-temperature synthetic-rubber program, announced the first cold-rubber product.

One of the factors responsible for the final production of cold rubber was the development of the MDN-ferricyanide polymerization system. Chemists at the



BATTERY OF REACTORS (polymerizer) in the new rubber plant mix the cold-rubber ingredients at 41° F. Cold rubber emerges as a milky latex.

University of Minnesota discovered that MDN (a "speedup" chemical of diazo thio ether class) combined with ferricyanide, gave unusually fast polymerization, even at low temperatures. Government laboratories carried the MDN-ferricyanide recipe to small pilot-plant scale and reported excellent properties for the rubber so prepared. Chemists at Phillips modified the Minnesota recipe to make it suitable for large-scale production.

This recipe, in general use at present, is a redox type utilizing a cumene hydroperoxide (CHP) as the oxidant. It is a Phillips' proposed "custom" recipe improved to a 41°F. redox system.

This year, Phillips has introduced a new chemical, Diox, which in all probability will replace cumene hydroperoxide in future cold-rubber production.—Oil & Gas J, June 30, p60

GRINDS FINE FLAT SURFACES

Business-machine print wheels of SAE 1010 steel are finish ground on a Blanchard grinder to ± 0.00025 in. Stock removal is 0.009-0.013 on each side. Magnetic chuck holds 113 parts. Retaining ring keeps parts on chuck surface. Grinding time for both sides is ½ hr.—Am Mach, June 30, p74

Vibroflotation Is Effective Sand Compaction Method

New, important sand compaction method is vibroflotation, a process of internal vibration together with saturation with water. Heart of the vibroflotation process is the Vibroflot, a 15-in. dia. vibrator unit 6 ft. 10 in. long. A rotating eccentric is a steel cylinder off-centered 1¼ in.

The Vibroflot is attached to 12-in. follow-up pipe sections by a transition section. The follow-up pipes are rigidly attached to a top section that has a cable-hook and a guide for preventing rotation of the machine during operation. Maximum vibrating movement is ⅜ in.

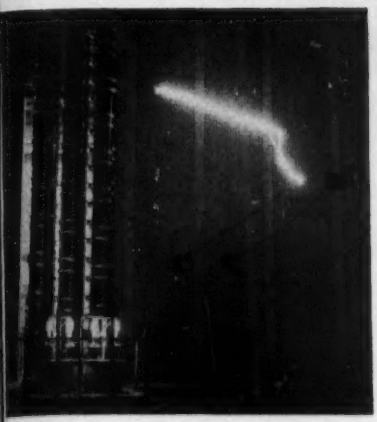
The compaction cycle at an insertion point is as follows: (1) Vibroflot set in a shallow hole and allowed to attain full speed; (2) bottom jet (upward flow around vibrator) is opened, providing a saturated mass of soil; (3) Vibroflot allowed to sink by its own weight; (4) bottom jet closed and top jet opened (downward flow); (5) sand in lower layer compacted; (6) Vibroflot retracted 2 or 3 ft. for next compaction, operation is repeated in stages to surface.—Eng News-Record, June 23, p60

Feldspar By Flotation

Froth flotation is being used for obtaining feldspar, iron-free quartz, and fine mica from large dikes of alaskite-granite at a new plant in North Carolina.

Most flotation concentrate is high in soda. As a result, there was resistance for a time among white ceramic users to use of the soda-type product. With increased competition, however, consumers found rather rapidly that they could use properly-blended soda types with entire satisfaction.

The belief is growing that within a few years the flotation concentrate will replace the product ground from pure feldspar.—Eng & Min J, July, p125



ARTIFICIAL LIGHTNING DISCHARGE

General Electric Co.'s new high-voltage engineering laboratory will permit experiments up to 15-million volts and 260,000 amp. Shown above is one of two 7,500-kv. impulse generators discharging artificial lightning to a high tension line in the laboratory's outdoor testing area.—Elec World, June 25, p21

Magnesium in Al-Cu-Si Alloys

Magnesium has a marked effect on the mechanical properties of aluminum-copper-silicon casting alloys. A minute amount reduces elongation and impact resistance severely because of its combining with silicon.

Up to 50% reduction in impact resistance occurs with 0.2-0.4% magnesium. Room-temperature aging reduces these values still more. Also, stress relieving at 450° F. results in marked embrittlement when magnesium is present.

These alloys with over 0.1% magnesium present should not be used in castings where any shock loading is expected. One advantage is that the presence of magnesium in an amount higher than 0.1% increases both strength and hardness of sand and chilled castings.—Foundry, July, p88

Stainless-Steel Threading Depends on Tools, Equipment

High output rates and uniform quality in threading and tapping stainless steel are gained by careful selection of equipment and tool materials.

Tungsten high-speed-steel tools meet most machining needs. Cast alloys are preferred for increased speeds, and carbides for continuous cutting. The choice depends on the specific application.

Cutting speeds are lower than for carbon steels, while the power required is about double. Tools must be kept sharp at all times. To prevent welding of chips to cutting edges, a sulphur-base oil having a small percentage of vegetable or animal fat is recommended.

Machine threading of stainless steel is claimed to be most successful with a self-opening tangential-chaser diehead. Lip rake angles are 22-25°. A cutting speed of 15-40 fpm. is suggested. Actual speed depends on thread pitch, type of thread, and condition of material being threaded.

Lathe threading is readily accomplished with tools of 6-9° top rake and 9-12° side rake. Depth of cut should start at 0.025-0.035 in. and reduce to 0.005 in. for finishing.—Am Mach, June 30, p71

Research on Piston Engine

In the lower than 500-mph. field of aircraft operation, the piston engine offers the advantage of being able to fly with 25–50% less fuel consumption at optimum cruising conditions than can existing turboprop or turbojet engines. Also, the piston engine can maintain its sea-level power to much higher critical altitude than turboengines because of the latter's operating temperature limitations and lack of supercharging.

The application of jet engines to the field of long-range flight must await the discovery and development of better materials and design principles or much cheaper fuels.—Auto Ind, July 1, p43

New Products

Dries Foundry Cores—Allis-Chalmers Mfg. Co.'s Foundromatic core drier can dry a wide range of core sizes in 2-20 min. It consists of radio-frequency heater, oven with electrodes, tuning assembly, ventilating system, and end conveyors. Advantages are improved core quality, reduced drying costs, better working conditions.—Iron Age, June 23, p83

Refrigerator Car Heating System—A thermostatically controlled method for heating railroad cars carrying perishable products has been developed by Luminator Inc. It embodies an underslung automatic-feeding charcoal heater.—Railway Age, June 25, p93

Produces Random Web—Random or non-oriented webs suitable for processing into felts or bonded-web fabrics can be produced on a continuous basis with Consolidated Machine Tool Corp.'s new unit. Low-cost, short-staple waste fibers, ⅛-2 in., can be used. Fabric has balanced physical properties without cross-laying.—Textile World, July, p141

Packaged Plant—Standby and emergency power plants, powered with 1-, 2-, or 4-cylinder, air-cooled engines, are offered by Kato Engrg. Co. Designed to run at 1,800 rpm., they are built in capacities from 5-200 kw. and in frequencies from 25-40 cycles.—Elec C&M, June, p148

Cardboard Nail Keg—New nail keg of corrugated cardboard reduces tare weight of nails. Introduced by Gaylord Container Corp., it is an eight-sided box with top and bottom covers that interlock with flaps extending from side panels. Steel stripping reinforces sides.—Mod Packaging, July, p101

Pressure Leaf Filter—A 48-in. rotating leaf filter made by Hercules Filter Corp. is intended for water filtration and light aqueous solutions. It has leaves center hung on rotating shaft. Filtered liquid is discharged through the center shaft which passes through the back of the horizontal filter tank.—Chem Eng, July, p135

Eliminates Vapor Lock—General Motor's new six-valve fuel pump eliminates "vapor lock" in tank engines. Its capacity is 200 gph. Pump has a static pressure of 4 to 5¼ psi. at 16 in. above outlet when operating at 1,800 rpm. Unique feature is pulsating diaphragm which takes the hard surge out of fuel flow by steadying the action of the valves.—Auto Ind, July 1, p45

CELL GUIDES METAL CUTTER

Contour-following system, developed by General Electric Co. to guide machine tools cutting metal parts, uses a photocell arrangement to follow lines of the master drawing. As cell moves over lines of the drawing, impulses are sent to a servo-mechanism controlling the lead-screw of the tool. As eye shifts, the tool shifts. If cell moves away from line, the electronic circuit instantly sets mechanical guides into motion to bring cell back into position.—Business Wk, July 9, p52

Push-button Card File—Posting of Kardex records is claimed to be speeded 30% with Remington Rand, Inc.'s push-button-controlled file. All clerk needs do is push a button denoting desired file and filed tray slides out in position for posting. Pushing the button again replaces the tray.—Business Wk, July 16, p56

Installs Dowel Bars—Flex-Plane Co. machine installs dowels and tie-bars in concrete pavements, thus eliminating dowel-holding devices. It vibrates bars through the finished surface to their exact position in the slab. Widths are 10-15 and 20-25 ft.—Cons Meth & Equip, July, p130

Package Radiator Repair Dept.—A "packaged" radiator repair department has been marketed by Inland Mfg. Co. It consists of a flow-test machine, boiling vat, back-flush booth, and test and repair benches.—Bus Trans, July, p150

Grinds O. D. Work—Cincinnati Milling & Grinding Machines, Inc., offers No. 1 and 2 Micro-Centric grinders for manufacturing bearing races and other short parts to tolerances of 0.000025 in. They use no centers or chucks, and are designed for either automatic or hand loading. Capacities: No. 1—work diameter of ¾ to 3½ in.; No. 2—2 to 8 in.—Am Mach, July 14, p146

Home-freezing Food Forms—Economical shape for home-freezing of fruits or vegetables is provided by polyethylene forms 4x4½x2 in. The forms can be used repeatedly; they fit into freezing unit of refrigerator. Sani-Therm Corp. also makes glassine bags the same size and shape of the form for storage of produce.—Mod Plastics, July, p57

Air Hoist—Ingersoll-Rand Co. BU midget single-drum utility hoist will lift a 600-lb. load at 50 fpm. Unit measures only 18½ in. long, 10¾ in. wide, and 11¾ in. high. It weighs 72 lb.—Coal Age, July, p178

Labeling Machine—Chisholm-Ryder Co. of Penna:'s new labeling machine permits a straight flow from container closing machines to case sealers. The unit labels the containers as they are elevated and discharges them 12 in. higher, thus eliminating need for elevators in the line.—Food Ind, July, p142

Repairs Tires on Wheel—Repairs to off-the-road tires without removing the tire from the wheel can be made with the R. E. Schlegel Vulcanizer. Special rubber is vulcanized into the cut without pressure. The 17-lb. unit can be used wherever there is current available.—Eng News-Rec, June 9, p89

Miniature Adjustable-speed Drive—Metron Instrument Co.'s new miniature variable-ratio speed changer weighs less than 6 oz., delivers 70 oz.-in. torque, and 0.025 hp. Body is 3 in. long.—Prod Eng, July, p170

Glass-block Window—Owens-Illinois Glass Co. has glass-block window with a sliding vision strip. It can be installed in conventional window openings. It is said to be strong and rigid enough to provide its own lintel.—Factory, July, p178

Photo-flash Lamp—Kemlite Laboratories is offering the electronic Sunflash for use in photography or where intense, instantaneous light values are required. As many as 100,000 flashes of metered consistency are realized.—Electronics, July, p126

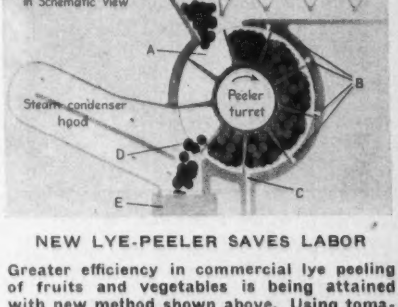
Spindle Shaper—Kearny & Trecker Corp. offers vertical spindle shaper which operates at two speeds, 7,000 and 11,000 rpm., to get correct speed with different size cutters. It has independently adjustable guides controlled by hand wheels.—Ind Dist, July, p112

Temperature Transmitter—A new force-balance-type pneumatic temperature transmitter is designed to have the indication, record, or control remotely located from the point of measurement. Made by Taylor Instrument Cos., it is used where it is necessary to have accuracy, high speed of response, small-thermal elements, and short range spans within the limits of —375° and +1000° F.—Oil & Gas J, July 7, p99

Electrical Insulation—New series of Laminated Plastics, Inc.'s heavy-duty Fiberglas-reinforced "Glastic" electrical insulating laminates has all the requirements of high-impact Class B insulating plate materials. Flame resistance is good.—Power, July, p142

Remote-control Timer—Pratt & Whitney Div., Niles-Bement-Pond Co., has developed a remote-control timing device that will direct, classify, or sort almost anything that is produced continuously or that travels on a conveyor mechanism. Typical application is to sort tinplate strip cut into sheets from a continuous coil at a rate of 1,000 fpm.—Steel, June 27, p98

Industrial Luminaire—Mazelite fixture features turret sockets for easy lamp changes and a hinged reflector to facilitate cleaning. It is all metal and finished with metallic gray permalux and white reflectors. Manufacturer is Edwin F. Guth Co.—Elec C&M, July, p219



NEW LYE-PEELER SAVES LABOR

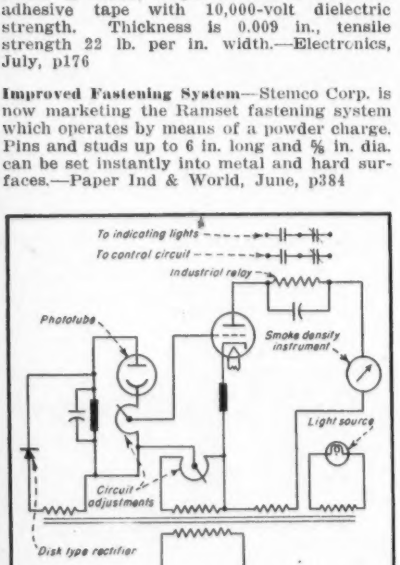
Greater efficiency in commercial lye peeling of fruits and vegetables is being attained with new method shown above. Using tomatoes as example, elevator slides lye-sprayed tomatoes into loading pocket A. Steam enters peeler shell through ports B, and leaves at C. Tomatoes discharge at D into washer at E.—Food Ind, July, p73

New Products (Cont.)

Graphite-filled Nylon—Nylatron G, a new graphite-filled nylon, has better wear resistance and frictional properties than unfilled nylon. Made by Polymer Corp., it can be used where a combination of rubbing and impact is involved. Applications include cams, cam followers, gears, washers, oil seal rings, and valve and pump packing.—Prod Eng, July, p166

Electrical Tape—Polyken 822, offered by Bauer & Black, is plastic-backed electrical adhesive tape with 10,000-volt dielectric strength. Thickness is 0.009 in., tensile strength 22 lb. per in. width.—Electronics, July, p176

Improved Fastening System—Stemco Corp. is now marketing the Ramset fastening system which operates by means of a powder charge. Pins and studs up to 6 in. long and ⅝ in. dia. can be set instantly into metal and hard surfaces.—Paper Ind & World, June, p384



CONTROLS FURNACE SMOKE

Excessive furnace smoke is kept under control by this smoke-density indicator. Density of smoke controls amount of light falling on phototube, resulting current fed to grid of vacuum tube, and its plate current that operates relay. Smoke density is indicated on meter in percent. Control circuit can be arranged to turn on blowers or overfire jets.—Power, July, p78

Automatic Chucking Machine—Single-spindle automatic chucker has five-faced overhead turret and two cross-slides to provide a large tooling capacity. A Warner & Swasey Co. development, this I-AC model handles work of up to 8½-in. dia. and 6-in. turned length. Speed range is 56-1,498 rpm. with 8 speeds. Eighteen feeds give a range of 0.002-0.08 in.—Am Mach, June 30, p126

Arc Welders—New line of ac. and dc. welders of Miller Electric Mfg. Co. have dual controls, separate excitation, instantaneous voltage recovery, and easy arc starting. Current range of ac. welders is from 15 to 300 amp., dc. welders from 30 to 400 amp.—Weld Eng, July, p56

Recommended for Waiters—Tuxedo shirt fronts of white Vinylite can be wiped clean with a damp cloth. Soft and pliable, the shirt can be rolled up for packing. Lukrite Plastic Sales Co., developer, recommends the shirt for waiters.—Mod Plastics, June, p83

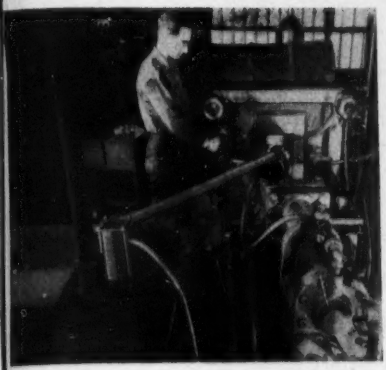
Aids Perspective Drawing—New draftsman's instrument makes perspective drawing comparatively simple. Instrument guides pencil toward established vanishing points. Special scales reduce distant portion of subject to correct proportions. It is made by Charles Bruning Co.—Cons Meth & Equip, July, p124

Vertical Shaft-Type Engine—VS-700 engine weighs approximately 35 lb., develops 1½ to 1¾ hp., is four-cycle, extra heavy duty, full carburetor equipped. It is available with or without mounting flange from Clinton Machine Co.—Oil & Gas J, June 23, p227

Portable M-G Set—Reliance Electric & Eng. Co.'s new 300-kw. portable motor-generator set is 43 in. high, 7 ft. wide, 16 ft. long. It weighs 19,000 lb. Driven by 2,300-v., 450-hp. synchronous motor, m-g. set can handle 25% overload for 2 hr. and 100% overload for 1 min.—Coal Age, July, p176

Cushions Water Hammer—Wade Mfg. Co.'s "Shokstop" provides an air cushion to absorb water-hammer pressure impulse which prevents water logging of the air chamber. A metal bellows allows free contraction and expansion of air sealed within it, but prevents all contact between air and water.—Eng News-Rec, June 23, p72

Universal Flame Hardener—Stearns-Roger Mfg. Co.'s new electronic flame hardener positively controls the four basic methods—spinning, rotary progressive, vertical progressive, and a combination of the three other methods. Preset temperature is held within close limits by means of a "heat eye". A 1-hp. motor drives the work table.—Steel, July 4, p117



AUTOMATIC ALUMINUM LADLE

Lindberg Engrg. Co. developed this automatic ladling device to remove molten aluminum from furnace to die-casting machines. Discharge chamber is connected to injection sleeve by graphite tube. Pressure from nitrogen tank is admitted to molten-metal surface to force metal through delivery tube. Timer that opens pressure-line valve is synchronized with die-casting machine controls.—Am Mach, June 30, p109

Feed-In-Duct—Unique feature of Square-D Co.'s new bus system is splitting of one phase on a three-phase job so the split-bus is positioned on either side of remaining two phases. This construction permits close spacing and electrical symmetry. Solid ebonized asbestos is used between and around the buses.—Power, July, p194

Rams Refractory Lining—Developed by East-Clay Products, Inc., machine lines or patches furnaces, ovens, ladles with refractory materials. It will handle ganister, crushed brick, silica sand, or grog up to 5/16 in. Material is mixed with water at gun nozzle.—Foundry, July, p214

Offer Head-Beater Ratio Selection—New dual-ratio head-beater selection on American Machine & Foundry Co.'s Glen "340" Mixer gives bakers two ratios on one machine for perfect whipping and mixing control.—Food Ind, July, p144

Measure Sound—New device, made by Massa Laboratories, Inc., measures directly sound pressure from 1-20,000 dynes per sq. cm. (116-decibel level). A multiplier is available for extending range to 200,000 dynes per sq. cm. (180 db.).—Electronics, July, p124

Operate at High Temperatures—A silicone insulating resin designed to permit electrical equipment to operate at temperature of 180° C. has been developed by General Electric Co. This thermosetting insulation has general application for impregnating spun glass and asbestos wire coverings and for binding coils, windings, and other motor, generator, and transformer parts.—Elec West, June, p60

Speeds Parts Inspection—Unskilled personnel can inspect and sort resistors, capacitors, and other impedance units at production speeds with a new tester developed by Industrial Instrument, Inc. Machine sorts passed parts into as many as eight groups on predetermined standards.—Aviation Wk, June 27, p33

Tap Chuck—Developed by a lathe operator, new tap chuck eliminates "center-and-wrench" method of tapping on a lathe or drill press. The tap floats. Seven sizes of tap adapters from 8/32 to ½ in. are available from Dahlstrom Mfg. Co.—Ind Dist, July, p130

Microfilms Both Sides—Both sides of documents can be microfilmed at once with Diebold Co.'s duplex camera-printer. Either 16- or 35-mm. film can be used. Up to 18,000 check-sized papers can be filmed per hr. Unit shuts down if two sheets are fed into it at once.—Business Wk, July 2, p49

Motor Speed Control—Operation of shunt motors up to ⅛ hp. from ac. line is possible with a single-unit speed control made by General Radio Co. Constant field voltage is produced by dry-dish rectifier. Variable armature voltage is obtained from an electronic rectifier fed by autotransformer.—Elec World, July 2, p102

Keeps Warp Tension Uniform—Designed to keep uniform tension on all ends in the warp, Walter Kidde & Co., Inc.'s tension compensator uses varying yarn tension to control pressure on a spring-loaded disk. Unit handles all yarns in any tension up to 20 g. Beam buckling, over-stress yarns, more yardage on beam, reduced down-time result.—Textile World, July, p146

READER SERVICE

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How To Cut Costs

With Value-Analysis Program

Unless a product is worth the money, it cannot maintain its position in the competitive market. Here is one way to make sure that it does

VALUE ANALYSIS operates in two main areas: study of existing products and design of new products. In those areas, the General Electric Co. has made it an important conception in modern industrial management.

Through value analysis, management makes the purchasing department a full-time partner in cost reduction. It brings to the engineering department a new outlook to component parts design. And it supplements, in the manufacturing department, the constant efforts of methods men and planners.

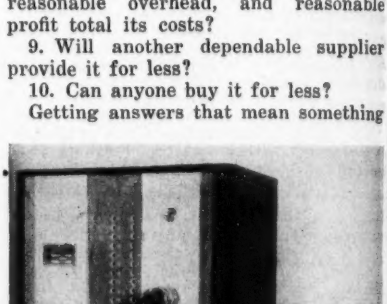
Value analysis focuses attention on each part. It notes its function, seeking to eliminate or simplify it, combine it with another part, or replace it with a standard item. It considers material used. It subjects manufacturing methods to critical examination. It reviews purchasing arrangements and supplier service. In all, it is an intensive effort to uncover every possibility to create greater value in the product and make it cheaper, better.

The value-analysis procedure begins by obtaining full information on the job: production quantities, blueprints, cost breakdowns, planning cards, actual part samples, and very importantly also, the opinion and cooperation of the design engineer.

The value analyst then weighs the value content of each piece in a product by seeking the answers to these ten questions:

1. Does its use contribute to value?
2. Is its cost proportionate to its usefulness?
3. Does it need all its features?
4. Is there anything better for the intended use?
5. Can a standard or a vendor's standard be found that will be useable?
6. Can a useable part be made by a lower-cost method?
7. Is it made on the proper tooling, considering volume?
8. Do material, reasonable labor, reasonable overhead, and reasonable profit total its costs?
9. Will another dependable supplier provide it for less?
10. Can anyone buy it for less?

Getting answers that mean something



COUNTS TO 10,000 PER MINUTE

High-speed electronic counter, designed for industrial applications, has counting speed of 10,000 per min. Made by Airlectron, Inc., it operates from photoelectric or magnetic-pickup sources. It can be connected to start and stop machine operation.—Electronics, July, p171

an only be done by considering every possibility; talking with engineering, manufacturing, purchasing, and sales; ontacting suppliers; negotiating with pecialized contractors.

Then decisions can be made: on elimnating or simplifying the part; changing naterials, process, tooling; selection of endor if the item is purchased. Thus, he basic principles of elimination and implification can then be satisfied, with he end result of a "No" answer to quesion 10.—Am Mach, July 14, p105

British Prestress RR Ties

Pressed by continuing shortages of lumber, England is making spectacular headway in the development of prestressed concrete for railroad ties. British prestressed concrete ties are made by two distinct methods: a "long-line" process; and by individual molds.

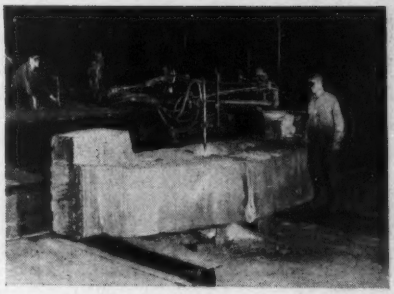
In the long-line process, two molds at a time, 460 ft. long, are filled with concrete on a vibrating table. Filled forms are drawn along 20 tensioned wires to final position, where the concrete is revibrated by surface-type machines. Wires are then cut. The entire cycle takes 5 days.

In the individual mold method, an aluminum mold takes the reaction caused by pretension of the wires. The tie contains a positive anchorage of cast iron blocks at each end, around which the wires are passed.—Eng News-Rec, July 14, p46

Measures Drift in Wells

A drift indicator, which mechanically measures, records, and checks drift or inclination measurements, was recently used in the drilling of the world's deepest test at Sublette County, Wyoming. The new instrument made more than 30 successive runs without failure.

Mechanical in detail, the instrument does not require the use of photographic papers. It is designed for high-pressure, high-temperature wells. Inclination marks are punched into a card at preset time, and a check mark is made later after a 180° rotation of the card. The drift indicator does not record the direction the well is going off vertical.—Oil & Gas J, June 23, p202



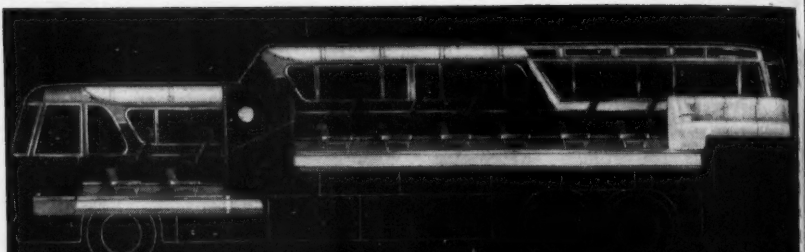
SEPARATE TWO FORGED CRANKS

Worthwhile savings in machinery are obtained by torch cutting a rough forging of alloy steel for two cranks as shown. Cranks were cut apart through section 29 in. thick and 5 ft. long. Holes shown on top were pierced with oxygen lance and roughed to diameter with torch. Forging was normalized, annealed, and preheated to 400° F. before cutting. Cut cranks were air cooled and drawn.—Weld Eng, July, p34

Shop-Built Package Units

Rather than laborious piecemeal assembly of various types of transformers and capacitors 25 or 40 ft. above the ground, units are now being designed so they can be completely wired in the shop, delivered to line crews as a package, and connected in an hour or so.

Careful thought should be given to the practice of hoisting 450 separate pieces (average for two-pole transformer bank installation) 40 ft. in the air and putting them together piece by piece, when such work can be done in the shop with power tools and where mechanics can move freely around the job.—Elec World, June 18, p76



GREYHOUND DEVELOPS THE SCENICRUISER

Design features of new 43-passenger motor bus includes greater visibility, smoother riding, and seating comfort. Raised rear compartment with wide front windshield gives unobstructed view. Lounge is at extreme rear. Air conditioning and ventilating system changes air every 40 seconds. 220-hp. diesel powers bus.—Bus Trans, July, p47

Chemical Sand Solidification Stops Water in Coal Slope

Heavy inflow of water under a 50-ft. head was encountered at a sand layer 3½ to 4 ft. thick while digging a slope in the Alpha Coal Co.'s new mine in Alpha, Ill. The water-bearing sand was rendered impervious by chemical solidification, after sump pumping failed.

To solidify the sandy soil, two gel-forming agents—a "joostenized" (named after Dr. Hugo Joosten, inventor of this sand solidification process) silicate of soda—waterglass and a reagent—were injected consecutively through specially perforated steel pipes.

When the two solutions came into contact, a silica-acid gel immediately precipitated and penetrated into the sand to form a sandstone-like mass.

After a few leaks had quickly been caulked in, the treated mass of sand stopped even the heaviest inflow of water.—Coal Age, July, p78

New Metallurgical Methods

Two new metallurgical techniques have been developed under the research program of the office of Naval Research. One is a method to determine accurately the hydrogen content of steel in 15 min. This would permit analyzing for hydrogen in the same time required for carbon, manganese, and other determinations.

The second technique involves use of x-rays to detect extremely small amounts of retained austenite in quenched steels. It would facilitate the study of embrittlement caused by decomposed austenite.

A specific application would be to determine whether rapid cooling in certain areas of welds results in austenite retention in undesirable quantities, thus causing brittle welds.—Steel, June 27, p36

Fabric Pads Protect Supports

Chesapeake & Ohio RR has recently installed fabric pads beneath the masonry plates of its new bridges. Purpose is to obtain even distribution of the load, absorb impact, and reduce the wearing of the masonry comprising the bridge seats.

Made by Fabreeka Products Co., pads consist of multiple layers of hard-woven duck. Each layer is $\frac{1}{64}$ in. thick. Layers are thoroughly impregnated with rubber and cured under heat and pressure. Finished pad is $\frac{1}{8}$ in. thick. It has unusual strength and limited set.—Railway Engrg & Maint, July, p670

"Wet Sleeves" Give Engine Added Hp., Easier Upkeep

Reo Motors, Inc.'s, new 6- and 8-cylinder truck engines are claimed by the manufacturer to develop more horsepower than other engines of similar displacement. One reason: Reo's "wet sleeve" principle, applied for the first time to truck engines.

The sleeves replace conventional cylinders, which are generally cast into the engine blocks. The sleeves are held in place by an overlapping gasket and two Neoprene seals. Water circulates freely about sleeves.

Sleeves can be individually replaced, reducing repair and maintenance costs. —Business Wk, July 9, p24

Develop Irregular Deposits

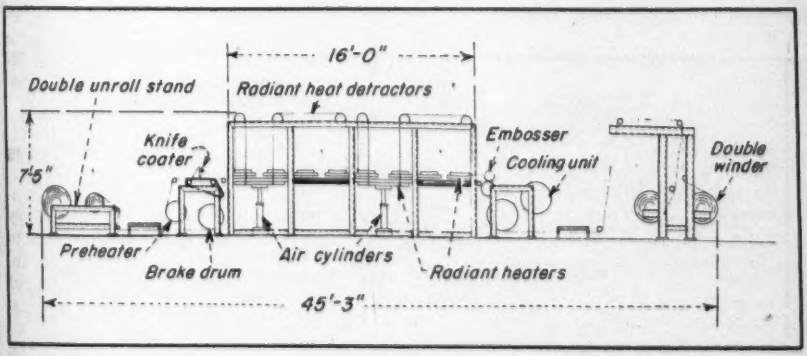
An ingenious contour mining method was devised to extract ore from irregular deposits of two Pend Orielle mines.

In searching for ore, a 6x7-ft. development drift follows a meandering offset vein of isolated lenses of ore. The drift is started in a favorable horizon at a given elevation and follows the mineralized zone, avoiding both foot and hanging walls.

Drifting continues through the mineralized ore zone along its approximate strike until a blank face is encountered. Work stops and short horizontal diamond drill holes are fanned out until another mineralized zone is encountered. —Eng & Min J, July, p105

Pack Ampoules Safely

New simplified method of packing ampoules safe against breakage involves common sense principle. Tray, in which the ampoules nest, is like a strip of single-faced corrugated board, except that the corrugations are especially full and tightly bunched and made of paperboard sufficiently strong to have some resiliency. When an ampoule is placed in the groove, it is held as in a spring clip. —Mod Packaging, July, p78



FABRICS COATED, EMBOSSED IN ONE OPERATION

Artificial leather or coated fabrics can be coated and embossed in a tandem operation by a new process developed by Atlas Powder Co. A single coat is used. New coating paste is 100% solid, containing no volatile solvents. Air-exhaust system is unnecessary. Fusion section is shorter, 16 ft., compared to other drying sections. Radiant-heat panels are 1-2 in. from face of coated cloth. Unit operates at speed of 15-35 yd. per min.; coating weighs 32 oz. per sq. yd.—Textile World, July, p154

Find Labor-Management Group Useful in Cost Cutting

Two separate, and independent, reports by the American Management Association and the American Federation of Labor on how employers can cut production costs reached the same answer. How: revive labor-management production committees. This won't do the entire job but both groups feel it will help.

These committees would study mechanical production problems and how to overcome them and what might be done to raise efficiency, morale, and welfare of the workers. Committee should meet about every other week. Membership should be equal between labor and management.

The AMA survey found four types of cooperative plans in common use in industry:

1. **Informational programs**—which limit labor and management to joint gathering of facts.

2. **Advisory cooperation**—which allows either party to consult the other on mutual production problems.

3. **Constructive cooperation**—which allows both parties to make suggestions for improvement.

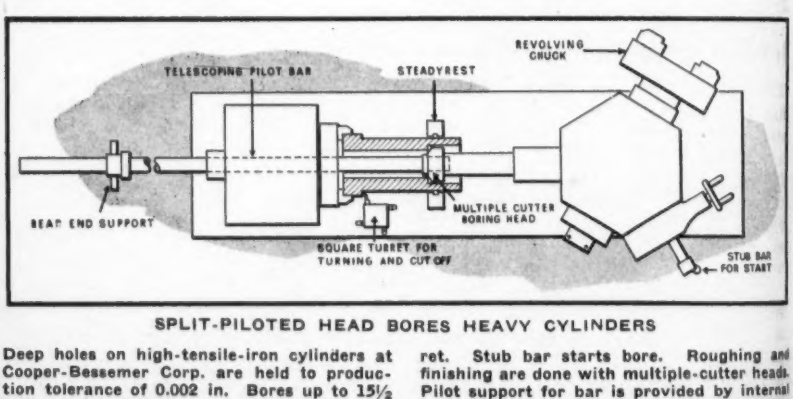
4. **Joint determination**—which gives labor an equal voice with management in meeting production problems.—Business Wk, July 9, p90

Tin-Coats Alcohol Tank

Metallizing steel storage tanks with tin is a practical way to prevent contamination of alcohol. Tanks are first blasted with steel grit to clean and roughen surface. Then the surface is sprayed with 0.0015–0.002 in. of 0.10% carbon steel.

This flash coating increases bond of tin to tank surface and prevents blistering during immersion. Surface is then coated to 0.020 in. by applying 1 lb. of tin to each square foot of area. Tin is applied in alternate vertical and horizontal passes to get a smooth, even distribution.

After metallizing, the coating is sealed by lightly blasting with No. 16 round steel shot at an air pressure of 35–50 psi. Final coat is thus made non-porous.—Chem Eng, July, p96



SPLIT-PILOTED HEAD BORES HEAVY CYLINDERS

Deep holes on high-tensile-iron cylinders at Cooper-Bessemer Corp. are held to production tolerance of 0.002 in. Bores up to 15½ in. in dia. and 49 in. long are machined with one rough and one finishing cut. Castings first are gripped in chuck while steadyrest bearing surface is machined from square turret. Stub bar starts bore. Roughing and finishing are done with multiple-cutter heads. Pilot support for bar is provided by internal telescoping pilot, or split-pilot. Lengthwise motion of pilot bar is controlled by hydraulic cylinder incorporated in pilot mechanism. —Am Mach, July 14, p94

Adding Dextrose Will Curb Color Changes in Acid Foods

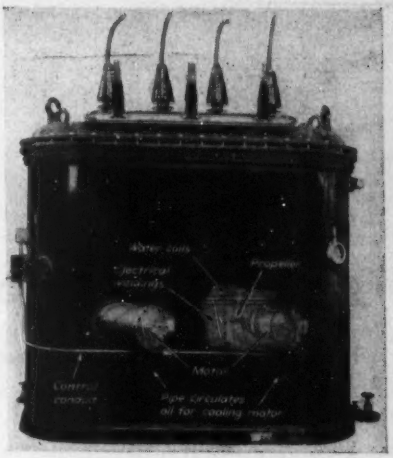
Dextrose, used as a portion of the sugars added to acid foods during heating, will curb color changes. The Technical Service Laboratories of Corn Products Sales Co. came to this conclusion after comprehensive testing.

Procedure was to boil dextrose, sucrose, and various mixtures of them at 60% total sugar level in water acidified by acetic, citric, of phosphoric acids.

For acetic acid, degradation of the sugar proceeded simultaneously with inversion; increase in color was an indication of breakdown products. The percentage of uninverted sugar, on actual sucrose basis, was greatest in the presence of increasing amounts of dextrose.

In the citric and phosphoric acid tests, dextrose appeared to have some inhibiting action—a function of anti-degradation.

Correlation of data in all three tests showed that dextrose and sucrose are definitely affected during short periods of boiling in acid solutions.—Food Ind, July, p40



PROPELLED-OIL COOLING

About 50% more capacity is obtained from this 8,500-kva. transformer by propelled-oil cooling. Marine-type screw propellers impart horizontal motion to cooling oil. Eddies caused by oil remove the heated oil from pocket (formed by concentric dish coils and coil spacers) and replace it with cooler oil. An increase in the heat transfer from the winding to the coil results.—Elec World, June 18, p88

Ice Detector Approved

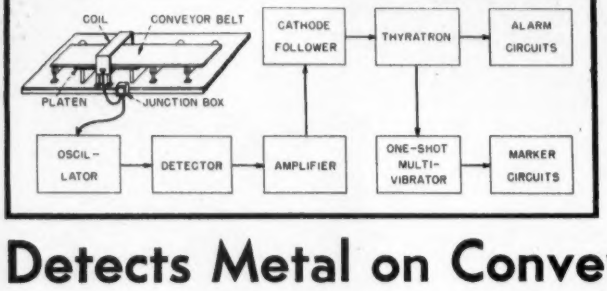
The Lindberg Carburetor Ice Detector has been approved by the CAA for installation on Continental C-75, C-85, C-95, and C-145 engines. The unit operates from a sparkplug lead, weighs 12 oz., and can be fitted in 30 min. to planes powered by these engines. The system consists of an energy pick-up, ice pick-up, coupling unit, and indicator unit.

When no ice is present, the system is fully balanced and no current flows to the indicator unit or the instrument panel. When ice forms on the pickup probe, the capacitance of the condenser is changed, unbalancing the circuit and causing current to flow to the indicator.

Present design is so sensitive that a change in capacitance of 1 mmf. is sufficient to unbalance the bridge circuit and light the indicator.—Aviation Wk, July 11, p21

Worker Efficiency Improved

Preparation of a manual on administrative procedures in the special projects department of the M. W. Kellog Co. is paying for itself many times over in improved worker efficiency. Because it gives some 230 technical employees of this department all the rules and regulations controlling their work, much wasted time, spent in asking questions on procedure or in correcting action begun in error, has been eliminated.—Factory, July, p127



BLOCK DIAGRAM of Eriez metal detector shows operation sequence as metal passes under the detector coil. Lines up to 40 ft. long can be used successfully between inspection coil and oscillator.

Detects Metal on Conveyors

Many industries must use metal detectors in their processing methods to locate metallic objects before they can do any damage to products

INDUSTRY is always confronted with the job of finding metal (nonmagnetic as well as ferromagnetic) in process media before serious damage is done to machinery or products—or in foods or drugs before they reach the consumer.

Radio Frequency Laboratories, Inc., has developed a detecting device (manufactured by Eriez Mfg. Co.) that works on the distortion of a radio-frequency field. Any metallic particle passing through or near the tank coil of a stable oscillator in the detector causes a momentary distortion.

This distortion may result in an increase or decrease in the efficiency of the tank and will be reflected back into the plate circuit as a change in the resistive component, thereby changing the voltage magnitude. If the change is in the negative direction and of sufficient steepness and magnitude, an alarm is given.

As shown in the illustration, material to be inspected is passed through the coil on a conveyor belt. The coil, together with a fixed capacitor, forms the tank circuit of the oscillator. A decrease in oscillator voltage, from r-f. field distortion, applies a positive signal to the amplifier grid.

Amplifier output, in the form of a positive pulse, is capacitively coupled to the grid of a biased cathode follower. Output of cathode follower is directly coupled to thyratron grid.

Positive pulse fires thyratron, causing an alarm relay to shut down the conveyor or ring an alarm. Firing of thyratron also deenergizes a marker relay through a one-shot multivibrator to control any marking devices.

Detector coils are designed for each specific application. They may range in size from 1 x 1 in. to 4 x 6 ft. with maximum sensitivities of 1/32- to 2-in. dia. steel balls, respectively.

The detector chassis is shock-mounted in a gasket-sealed aluminum case, permitting installation in exposed locations. Little space is needed in the inspection area as the detector can be located up to 40 ft. from the coil.—Electronics, July, p80

Product "Mechanized" Food

Sandwiches—unusual, tubular, molded, filled snacks—are being manufactured on an assembly-line basis in Los Angeles. Cavities are made in the bun, filler is extruded into it, sandwich is packaged and cased, then stored in a refrigerated room. Sandwiches are delivered in refrigerated trucks to retailers who heat them in special 10-sec. toasters before serving.—Food Ind, July, p62

Maintenance Rated Voltage Vital to Plant Efficiency

Production efficiency and maintained rated voltage throughout a plant's distribution system are directly related. When electrical equipment operates below or above rated values, life and performance of equipment are affected severely.

When voltage is 10% below normal, resistance-type heating equipment, such as soldering irons, produce only 80% as much heat as when normal voltage is applied. Induction motors have a 19% decrease in torque and 2% decrease in efficiency. Incandescent lamps have 70% rated output. Fluorescent lamps have 15% reduction in lumen output and 30% reduction in life.

With voltage 10% above normal, heating devices have shorter life. Induction motors have 21% increased torque, power factor is increased 3–6 points, starting current is increased 10–12%. Life of incandescent lamps will be down 71%, and of fluorescent lamps 20%. Maintenance of motor-driven equipment will be increased.

The problem is easily solved. One way is to convert the system to a load center substation plan. Another is the specific application of induction voltage regulators.—Elec C&M, July, p207

Adopt Hydraulic Disk Brake

The "Hydradisc," a new hydraulic brake, differs radically from conventional automobile brakes in that a cast iron disk, instead of the brake drum, rotates as part of the wheel. It has been adopted by Crosley Motors, Inc.

In place of brake shoes, there are two 1¼-in. disks of brake lining material fixed on opposite sides of the rotating disk. When the brake is applied, these friction "spots" clamp against the disk under hydraulic pressure.

Because the two "spots" engage only a small part of the revolving disk surface at a time, the rest of the surface remains comparatively cool. Application of braking pressure on a disk instead of on a drum is said to prevent "fading," which sometimes results from accumulation of mud, water, snow, or oil in the drum. It is claimed that these are slung off the disk by centrifugal force.—Motor Age, July, p38

Makes Old Presses Safe

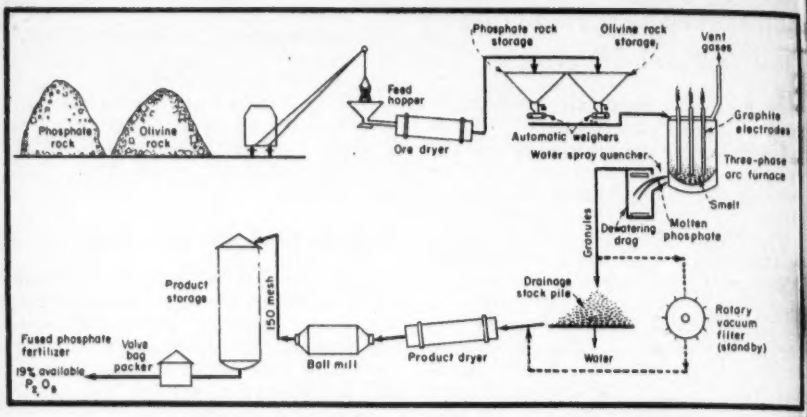
Old punch presses without two-hand safety switches can be fitted with two pushbutton switches and a solenoid. Switches are located on each side of the front of the bed and wired to a solenoid that is connected to a catch.

Normally the catch fits under the pedal lever and prevents any downward motion. When the operator presses both pushbuttons, the solenoid moves the catch so the pedal can be depressed to trip the press.—Am Mach, June 30, p104

Convention Calendar

(Equipment Exhibited)

Sept. 12–16	Instrument Society of America National Conference and Exhibit, Municipal Auditorium, St. Louis, Mo.
Sept. 26–28	National Electronics Conference and Exhibit, Edgewater Beach Hotel, Chicago, Ill.
Oct. 5–8	Society of Automotive Engineers Aeronautics Meeting and Engineering Display, Biltmore Hotel, Los Angeles, Calif.
Oct. 17–21	National Metal Congress and Exposition, Cleveland, Ohio.
Nov. 28–Dec. 3	Chemical Industries Exposition, Grand Central Palace, New York, N. Y.



ELECTRIC-FURNACE FERTILIZER: CA-MG-PHOSPHATE

Manganese Products, Inc., is now making fused phosphate fertilizer from phosphate rock and olivene (containing 8% iron). Materials are dried, weighed, and fed to fusion furnace. Molten phosphate is quenched by water spray. Resulting granules are dried, ground, and sent to storage. Product as fertilizer is comparable to single superphosphate. It is particularly suitable for acid soil.—Chem Eng, July, p103

Use Collapsible Wire Baskets

Substitution of collapsible wire mesh basket pallets for traditional canvas baskets in its yarn handling has brought Beattie Mfg. Co. five distinct advantages. They are:

1. Weighing operations in winding room require one man instead of four.

2. Storage and handling require only three people instead of twelve.

3. Handling operations are cleaner, and there is less chance of confusing the many colors, lots, and types of yarn used in the plant.

4. Taking a complete physical inventory of some 400,000 lb. of yarn requires only six persons on a weekend. Previously this took fifteen persons a solid week during shutdown.

5. Checking of perpetual inventory can be done in a few hours at most, sometimes in a few minutes.

These advantages are generally attributed to two factors: the wire mesh containers have a capacity of 530 lb. to 50 lb. for the canvas baskets; and the new containers can be handled by fork or hand pallet trucks, while canvas baskets were handled manually.—Factory, July, p92

Improve Circuit Protection

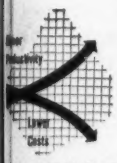
Short-circuit protection for lower voltage feeders and distributing systems has been improved through a current-limiting device. Performance is based on the use of composite link elements, of which silver is one.

It does not interrupt current, but is said to stop or limit instantaneously the build-up of short circuit current. The arc gap is short, and the arc path small in cross-section and of high resistance. Potential drop across the arc is instantaneously established at a value equal to, or greater than, the circuit voltage, and the current flow is cut off in microseconds.—Elec World, July 2, p92

low to Cut Costs

Better Product Design Means Lower Costs, Higher Quality

—Report to Management—



THE FIRST ATTACK on production costs of a product must be made by the design engineer. How much money he should spend on the engineering of a given project cannot be established by any known formula. His cost—the basic engineering cost—is the amount required to reach a satisfactory solution of design problems, plus that necessary to put the solution into a form others may use.

When production quantities are small, costs can be kept reasonable only by simplification, adherence to previously developed practices, and use of short cuts in preparation of engineering data. But with large production quantities, introduction of more original engineering practices are justified. Better and cheaper methods can then be developed to take advantage of potential economies. Product design must be governed accordingly.

In every instance, the design must be compatible with the number of units to be manufactured. The designer must consider material, manufacturing and assembly methods, finishes, and even the advantages that standardization of parts and product can provide.

Close analysis and ingenious design can result in cost savings. Thus, short-run die-casting dies are not nearly so costly as dies built for long runs. And sheet-metal parts can often be produced economically with "temporary," or low-cost dies.

Many designers go so far as to avoid specifying close tolerances because of the "high cost of accuracy", even though a precise dimension might be highly advantageous. Here again, careful analysis of the job can give an acceptable solution.

Reducing the magnitude of the tooling and manufacturing problem lowers the final cost. Among the important principles that contribute to this solution are the following:

1. General configuration of a machine or structure should consist of a minimum number of major elements and employ simple shapes.

2. Major breakdown of a complex structure should provide for assembly accessibility, complete installation of systems in subassemblies, and simple connections between subassemblies.

3. Structure and equipment should be designed for maximum simplicity, accessibility, and minimum number of manufacturing operations.

It is obvious that product design can mean the difference between meeting competition and an idle plant. Ingenuity, judgment, and design know-how control the basic cost.

How design engineers have put these qualities to work to gain producibility of a product, to lower production costs, and to permit manufacture at a profit is covered in the following pages.

This report to management brings you ideas galore that can be applied quickly and easily to reduce your production costs. The original article—an 88-page section from Product Engineering—will be sent, as long as available, on receipt of our minimum price of one dollar.

How To Cut Costs

MATERIALS AND PROCESSES

Materials, in most instances, constitute an important element in the final cost of a product. The designer, to a large extent, controls this cost through selection. Exact costs of specific materials naturally vary with quantity, shipping requirements, and other factors beyond his control.

As material selection is so closely related to processing method, here again the designer influences final product cost. It is he who chiefly decides whether the part can be made, for example, of a low-cost steel stamping, die casting, forging, or by other means.

The designer should strive, by consideration of different materials that can be used and by selection of the proper material and method, to effect the lowest product cost. But not always does this mean that the lowest cost material should be chosen.

Design Offsets Material Cost

Westinghouse Electric Corp. uses a single-piece jaw of beryllium-cobalt-copper alloy on an electrical disconnect switch in place of the usual contact jaw backed up with springs. This alloy, of high electrical conductivity, makes an excellent spring to maintain contact pressure. Simplification reduced final cost by more than offsetting higher alloy cost.

New developments should be watched by design engineers. At least one steel producer, Armco Steel Corp., is making an extra-low-carbon stainless steel. This steel can be welded or heat-treated without danger of subsequent intergranular attack. As its cost is about halfway between those of stabilized and unstabilized stainless steels, it will find many applications in equipment for the processing industries.

Plastics too offer a fertile field for the designer looking for new, different materials. They present a profitable method of cost reduction in many applications. But even now, they too often are overlooked, especially when a designer regards their cost on a weight basis only. On this basis, cost appears much higher than when calculated on a unit volume basis.

Two Important Plastics

Two plastics should be given special attention—polystyrene and general purpose phenolics. Polystyrene can be molded easily into complicated shapes of large cross-section. The injection molding means a low production cost, in addition to low material cost.

Polystyrene, because of its extremely low moisture absorption at low temperatures, is excellent for refrigerator parts. Production cost of these polystyrene parts is many times less than those of the metal, glass, and paperbase phenolic plastic parts they replace. One such typical part is the freezer door on the new Crosley refrigerator.

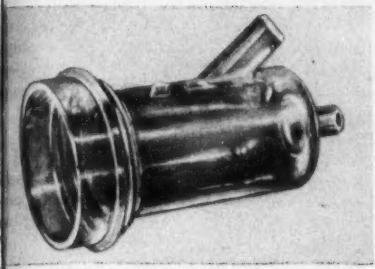
The designer too should always consider carefully the number of components making up a product. A milking-machine head was simplified by injection molding from polystyrene. Result—one plastic molding to replace 20 different components, with additional savings made in assembly and finishing. Another advantage is freedom from taste and odor.

Fewer Parts, Lower Cost

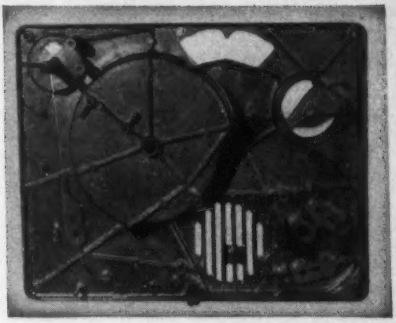
Another such example is the one-piece journal box made by Timken Roller Bearing Co. The new box is made of a one-piece forging that is forged, trimmed, closed to shape by rolling and bending, and finally welded by submerged arc.

Adel Precision Products Corp. by redesign of a hydraulic hand pump has achieved fewer parts, lower costs. The first model had chevron-type packing on the plunger, steel liner inside cast-iron pump body, and a two-part plunger. The new model has an integral-unit plunger, no liner, and "O"-type packing.

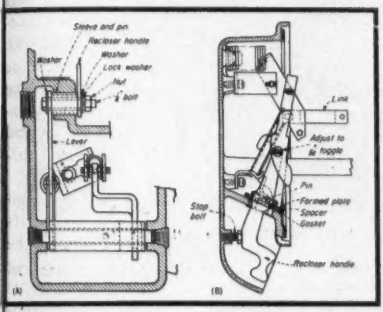
ow To Cut Costs



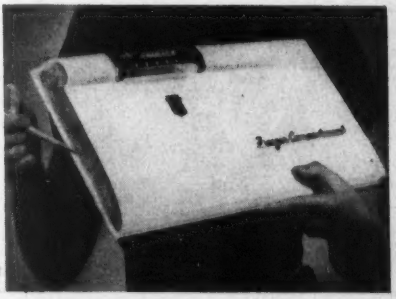
HILKING-MACHINE head of molded polystyrene replaced 4 brass castings, 2 wire angers, and 14 other miscellaneous parts.



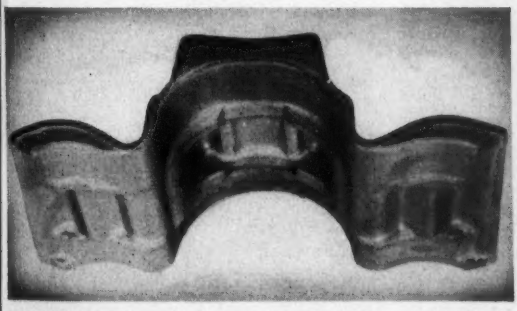
DIE-CAST zinc-alloy frame for Lear, Inc. wire recorder has all openings and bosses cored, needs no machining.

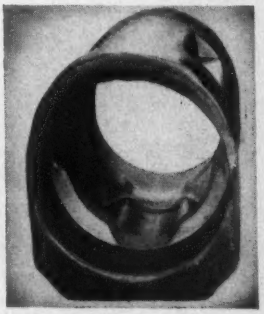


HANDLE for circuit recloser was redesigned, (A) to (B), to replace bushing seal with water-tight plate-and-gasket seal.



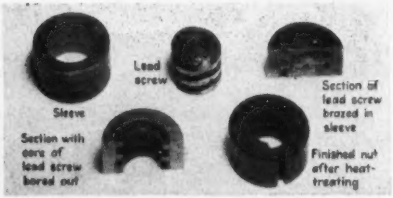
FREEZER DOOR of Crosley refrigerator is made of two polystyrene parts with insulation between them.



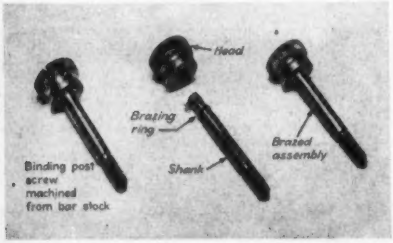


JOURNAL BOX, made in one piece by Timken, is forged to partially formed section (left), trimmed, closed, and welded together (right). The present cost is considerably lower than for cast and machined journal boxes.

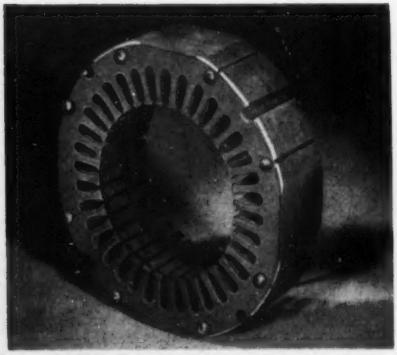
ASSEMBLY METHODS


Lead screw
Sleeve
Section of lead screw brazed in sleeve
Section with core of lead screw bored out
Finished nut after heat-treating

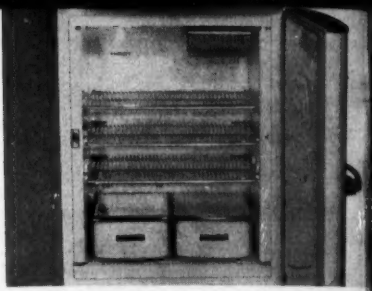
LOW-COST furnace-brazed assemblies were made by brazing steel lead screw into steel sleeve, then boring out core. Machining costs were reduced considerably.



MATERIAL SAVINGS of 50% were made by designing brass screw to be furnace brazed from two screw-machine parts. It replaced one part machined from bar stock.

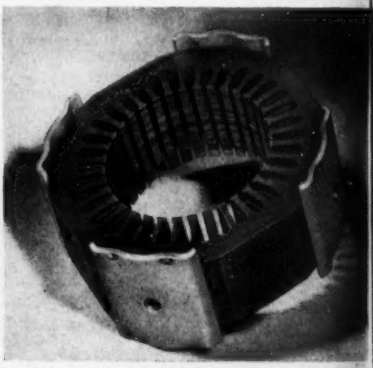


MATERIAL AND LABOR savings resulted from redesign of motor laminations by Delco, General Motors. Former laminations were assembled by eight rivets. New motor has four struts welded onto lamination edges to hold stack together. Electrical characteristics are improved as no material is removed for bolt holes and shoulders.



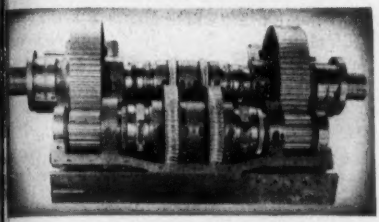
REFRIGERATOR made by General Electr has aluminum shelves and baskets, replaci stainless steel that required more than 1 welds.

SWITCHING from all-cast to welded con struction and using Nelson stud weldin saved 54% on Globe Mfg. & Compressor Co.'s compressor crankcase.

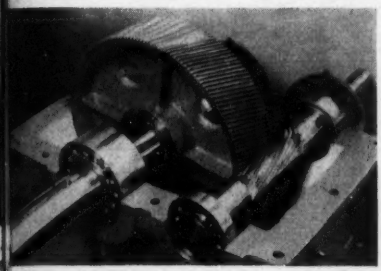


How To Cut Costs

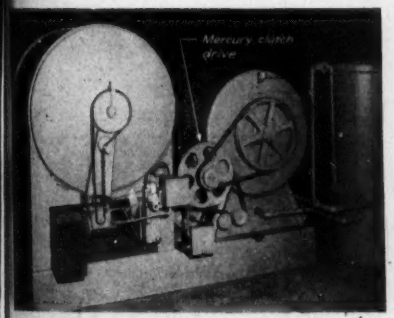
MACHINE ELEMENTS



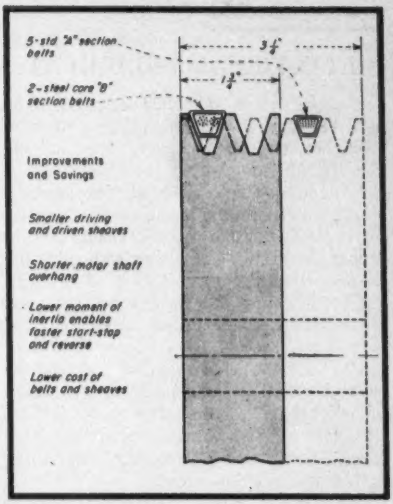
OLMOL, Sunnyhill Coal Co.'s mechanical miner, has Cone-Drive traction gearing to save space and larger components.



SPEED REDUCER by Stephens-Adamson has helical pinion cut on shaft to reduce size and cost of unit.



DRYCLEANING machine, made by Manitowoc Shipbuilding Co., has mercury clutch drive so 2-hp. motor can handle 25% more capacity at 6% greater speed. Motor speed is held steady.


5-std "A" section belts
3¼"
2-steel core "B" section belts
1¾"
Improvements and Savings
Smaller driving and driven sheaves
Shorter motor shaft overhang
Lower moment of inertia enables faster start-stop and reverse
Lower cost of belts and sheaves

FEWER V-BELTS mean direct cost saving. Here five standard "A" section V-belts are replaced with two steel core "B" section belts on Warner & Swasey turret-lathe drive.

CHAIN DRIVE for wire-belt conveyor is here used with gear reducer because of low cost and relatively long distance between shafts. Uses include construction, packaging, and textile equipment.

How To Cut Costs

ELECTRICAL EQUIPMENT

Major factors affecting the cost of ac. squirrel-cage induction motors are rated capacity, operating speed, type of enclosure, and operating voltage.

Capacity—For integral horsepower units, a 1-hp. motor is the most expensive on a cost-per-horsepower basis. The larger the rating, the lower is the cost per horsepower. Thus, unit cost of a 50-hp. explosion-proof, fan-cooled squirrel-cage motor drops to less than one-third that of a 1-hp. motor.

Use of one large motor instead of several smaller ones to drive a number of machine elements may save money. But cost of the connecting drives may offset the saving, making individual drives more economical.

Speed—The higher the speed (up to 3,600 rpm.), the lower is the unit cost. Frame size is proportional to speed for a given horsepower rating. The same frame size would be required for a 5-hp. open-type motor operating at 900 rpm., a 10-hp. motor at 1,800 rpm., and a 15-hp. motor at 3,600 rpm.

Higher-speed machines also have better efficiency and power factor than lower-speed machines of otherwise identical rating and type. When a low driving speed is required, it is often more economical to use a high-speed motor with some form of speed reduction than a low-speed motor with low efficiency and power factor.

If a wide speed range is needed, common practice is to use a dc. motor and either electronic or rotary converters (so-called adjustable speed drives). Over 1 hp., cost of variable speed with rotary converters is less than with electronic conversion.

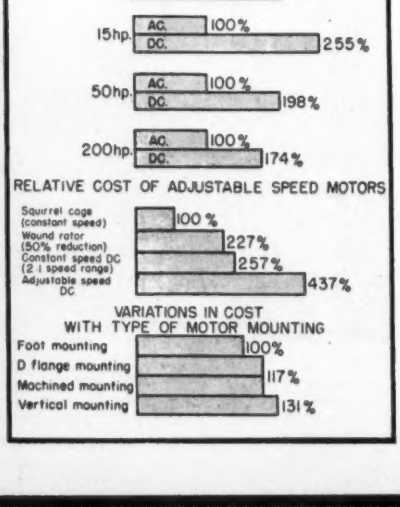
Cost of electronic variable speed at 1 hp. is 15–20% greater, at 5 hp. 50–60%. For fractional horsepower ratings, electronic conversion is cheaper.

Type of Enclosure—As the motor enclosure becomes more complex, the cost becomes greater. But contrary to this general rule, an enclosed non-ventilated motor is more expensive than an explosion-proof, fan-cooled motor because a larger frame is needed to radiate the heat. Another advantage of the simplest type enclosure is that less space is needed for mounting, especially in the higher horsepower ratings.

Voltage—Motors operating at 2,300 volts are more expensive on a unit basis than motors designed for lower voltages. Their uses are limited, so this cost factor is of little interest.

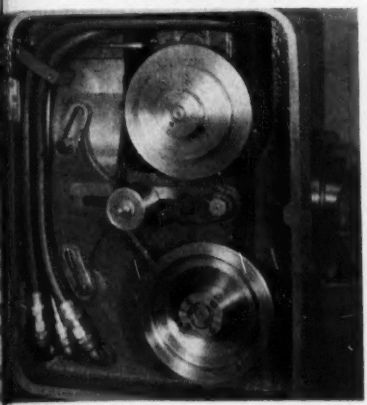
Besides these four factors, mountings and bearings affect the cost. Vertical-shaft motors are slightly higher in cost than foot- or flange-mounted motors. For units larger than 125 hp., a sleeve-bearing motor costs about 5% less than a ball-bearing motor.

These conclusions, as well as the cost chart, are based on averaged prices from different manufacturers.



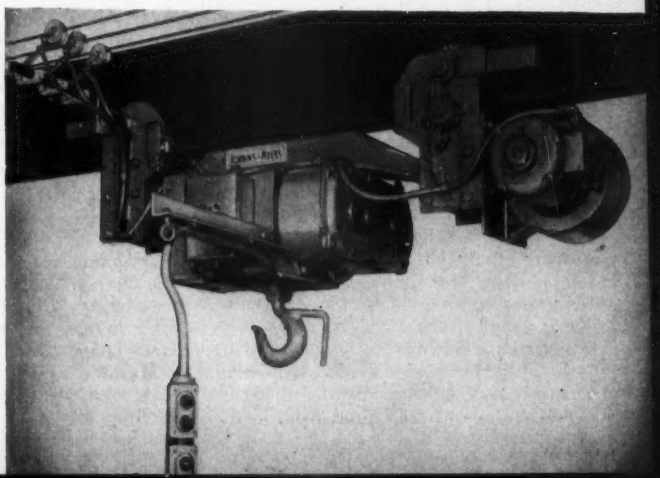
w To Cut Costs

HYDRAULIC AND PNEUMATIC EQUIPMENT



ONOMICAL drive on Excello thread nder consists of variable-speed hydraulic k-drive motor installed with flexible hose t reduces assembly cost. V-belt idler minates need for variable sheave center ance. The Resistoflex hose, which can be ily and quickly installed, is good for pres- es up to 1,200 psi. and is not subject to rosion.

OUBLE - ACTING draulic coupling, ed to horizontal ive transmission on bbins and Myers' otor-driven hoist, proved performance, costs. Wiring is s complex, control easier to assemble d maintain, and less ace is needed for unting of controls. A irrel - cage motor as substituted for p-ring motor previ- ly used. Other ad- ntages—a cushioned art and a stepless nge of speed accel- ation from zero to aximum.



Accumulators Reduce Power Requirements

Hydro-pneumatic accumulators, when mounted on flash-welding machines, reduce their cost by making possible the use of smaller pump-and-motor units. They also reduce work spoilage, assure uniform welds, and lower maintenance costs.

A new design of a Federal flash-welder hydraulic circuit includes a flashing control valve as well as Greer accumulators. Capacity of accumulators is sufficient to operate the upset cylinder quickly during fusion part of cycle. They are loaded during stand-by time and also during periods when oil requirements are at a minimum, making possible the use of a small pump, motor, and sump tank.

Advantages of accumulators and flashing control valve are: (1) faster operating speeds; (2) heavier materials can be welded; (3) constant pressure during welding; (4) line linkage is compensated; (5) low maintenance cost because accumulators have no moving parts; (6) installation space is small; and (7) pressure drop is low over a wide capacity range.

How To Cut Costs

SURFACE FINISHES

Cost of finishes on stainless steel depends to a large extent on specifying the correct grade of steel. Another factor is the finish that is ordered.

As shown in the table, there are seven basic variations of finish obtainable on 18–8 stainless-steel sheet alone. Furthermore, the finish varies between different grades, thicknesses, and forms of stainless products.

Chromium stainless steels of the ferritic or martensitic type generally have a higher finish in cold-rolled strip than do the chromium-nickle types. Also, the higher the alloying content, the more the surface is affected by heat treatment and scale removal, resulting in a more open surface with less reflectivity.

Lighter gages can be given better finishes. The equipment on which the product is made affects the finish. A No. 2 finish on 20-gage strip shows a tighter, smoother surface than on 20-gage hand mill sheet.

Consideration of the relative costs of different finishes can reduce final product cost. Specification by the product designer of too fine a finish, however, may even cut costs by eliminating subsequent polishing of the fabricated product.

When additional finishing is desirable, electroplating often provides a cheaper finishing method than mechanical buffing. Anodic treatment should be considered for rough, broken surfaces that are severe on buffs and grinding wheels.

Porcelain Enamel—Many applications involving porcelain enameling indicate potential cost savings. When used as a bearing material, for example, low-temperature porcelain enamel improves the performance and life of switch plates. Thus, a more competitive product can be produced at relatively no increase in cost.

A similar example is porcelain-enameled saggers (containers for firing carbon parts). Made of steel pipe, 8 in. in I.D. and 18 in. high, they have a service li three to four times greater than sagge made of plain steel pipe.

Unit cost is twice as much, but a 50 saving in over-all cost is achieved by lated economies. These include less we ing time and a decrease in product l resulting from sagger failure or fr sand sticking to sides of saggers.

Special enameling steel, developed Inland Steel Co. and Titanium Alloy M Co., is reducing production costs of ap ances. This titanium enameling st bonds closely with titanium-bearing p celain enamel. No ground coat is nec sary. The enamel is applied directly o a flash coat of nickel.

Advantages include (1) good resista to chipping, (2) high sag resistance, tensile strength and hardness grea than for enameling iron, and (4) form bility about the same.

Cost of titanium steel is greater th that of enameling iron. But added c can be overcome by eliminating grou coat and the accompanying drying a firing operations, by using no oversp of special acid-resisting enamel, by spe fying a thinner sheet gage, and by ducing the amount of packaging mater required for shipment.

Wrinkle Finish—American Televis & Radio Co. reduced processing time the paint department for its rectifi and inverters by specifying a wrin finish. Also, a mechanical sanding op ation to smooth rough welds w eliminated.

To have applied a baked enamel fin would have required a "fill" coat. Furth more, the enamel would have had to rubbed or else more time spent in app ing than could be justified.

Abrasion tests on the wrinkle fin showed a substantial increase in abras resistance. Gloss finishes were mar even in contact with normal packag materials.

Machine Finish—Cost and quality main considerations in specifying type machine finish. The designer sha

Surface-Finish Costs on 18-8 Stainless-Steel Sheet

Finish Classification No.	How Sheet Is Produced	Application and Remarks	Relative Cost of No. 20-Gage Sheet-%
1	Hot rolled to gage, annealed and pickled.	Used when the greatest possible softness and ductility is required.	100
2B	Annealed and pickled, then cold-rolled with bright rolls.	Generally used when polishing is required after deep-drawing operation.	100
2D	Annealed and pickled, then cold rolled with dull rolls.	Finish 2D is slightly softer and more ductile.	
4	Annealed, pickled, cold-rolled, ground, and polished.	Most popular finish. Used for brake forming or roll forming. Used for sinks, food equipment, and textile dyeing equipment.	129
6	Annealed, pickled, cold-rolled, ground, polished with pumice, kerosene, oil.	Applications requiring "butler finish." Architectural applications to cut down reflectivity.	148
7	Annealed, pickled, cold-rolled, ground. Polished, and buffed. Dull or bright.	Used where higher luster and reflectivity beyond No. 4 finish are required.	166
8	Annealed, pickled, cold-rolled, ground, polished, and buffed using finer grain abrasives. Dull or bright.	Very few uses for this finish except for press plates in plastic industry and similar applications. Sheets sometimes chromium plated.	314

all for only as smooth a finish as necessary.

The Crosley Div. of Avco Corp. specifies the following five major machine finishes and has worked out cost estimates for each one: rough-machine, standard-machine, fine, journal, and lapped finishes.

Rough-machine finish, produced by filing, rough grinding or rough machining, is equivalent to that obtained by rough turning with a coarse feed consistent with part size. Tool marks are permissible, and plane surfaces may deviate slightly from a straight edge.

Standard-machine finish is equivalent to that obtained by turning with a finishing tool with cutting-edge width double the feed. Tool marks are apparent, but plane surfaces should not deviate perceptibly from a straight edge.

Fine finish indicates a still smoother surface, obtained by grinding or a light machining cut of 0.005–0.010 in.

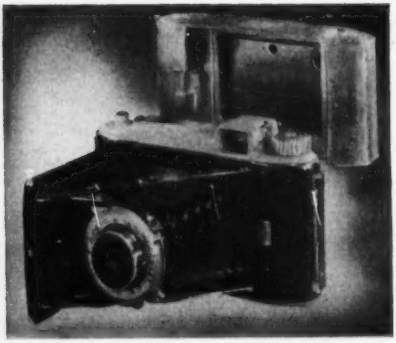
Journal finish is a high polish produced by machine grinding. Quality is equivalent to that obtained by "sparking out" on a wet grinder.

Lapped finish is obtained by hand or machine lapping. Equivalent is that produced on stainless steel by lapping a journal finish with grade No. 2 alumina on a soft lap.

Finish costs vary with machining methods, shape and size of part, and material. Approximate cost relationships are as follows:

Type of Finish	Cost-%
Rough-grind or file	100
Rough-machine	250
Standard-machine	500
Fine	1,100
Journal	1,800
Lapped	6,000

How To Cut Costs



ONE-PIECE aluminum die casting forms body of Eastman Kodak line of folding cameras. Viewer is now part of plastic top, instead of a separate part on the body.

AIR-FLO makes 102 models of air compressors from 24 principal parts. Omissi of two central cylinders would make a 4-cy model of this type compressor.

STANDARDIZATION

Amortization of engineering charges, tooling and production costs, inventory, purchasing—all are affected favorably by standardization of products and interchangeability of parts.

As an example, Joy Mfg. Co. manufactures 124 models of vaneaxial industrial fans with only 4 different hub diameters, 15 casing diameters, 4 sets of blades, and motors of various speeds and capacities.

This standardization has resulted in a quality product at low price and a line to cover wide range of operating conditions. Actually, over 1,000 variations in models can be obtained by interchange of fan components. Units are compact and easy to install.

Eastman Kodak Co. also has adopted standardized construction. It has enabled the company to avoid appreciable price increases on its line of folding cameras. One standard body was designed to replace three bodies previously used.

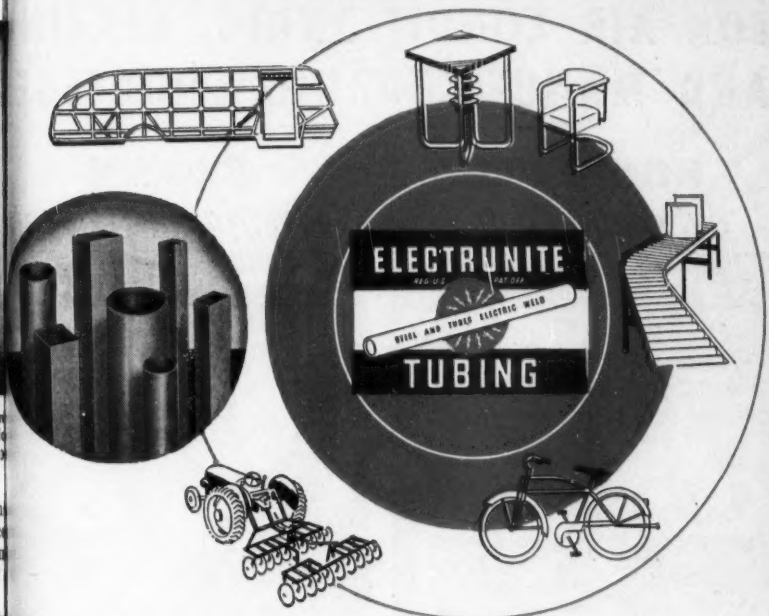
Many economies have been the result. A single, high-speed production line has replaced three independent operation Parts inventory and purchasing proce dure have been simplified. Manufactu ing costs have been reduced by use of die casting.

Other examples of standardization in clude Westinghouse 15-kva. capacitor that can be connected in parallel to mak larger capacitors, Stewart-Warner sec tionalized cabinets for assembly of differ ent sizes of lubrication units, and th Air-Flo Compressor Co.'s line of ai compressors.

In this line, 48 different models of ai compressors can be assembled from 1 principal parts. With 6 more parts, in cluding an additional size of piston and cylinder with head, 102 models can b made.

Common parts include flywheel, en plate, connector rod, outlet and inle valves, cylinder head, and manifold Cylinders, pistons, rods, crankcases differ in size.

The number of combinations also ca be increased by using an eccentric car on the crankshaft of one model series to change the length of stroke.—Prod Eng June, p81



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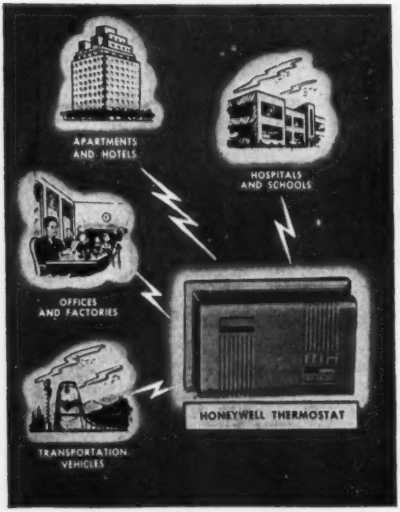

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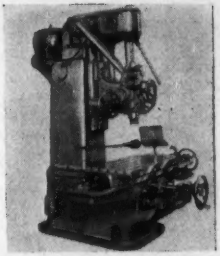
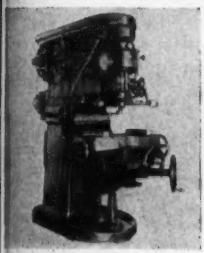


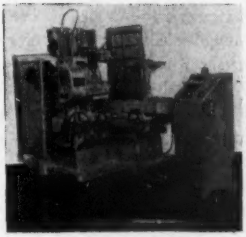
P&W No. 2-A JIG BORER

—locates its work with end measures, inside micrometers and dial indicators . . . bores at high speeds to precision limits . . . then checks its own work to "tenths" accuracy. It is the key machine for basic toolroom accuracy, excellent quality work, and low cost precision boring. Regular equipment in either English or Metric systems.



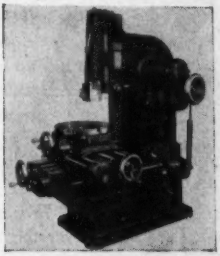
P&W UNIVERSAL DIE SINKER

—accurately machines die cavities with characteristic P&W ease, precision and economy. Quick change from straight cuts to cherrying cuts, with exact position of cutter always indicated on graduated dial. Uses standard die sinking cutters.



P&W Type BL KELLER MACHINE

—automatically produces dies, molds, metal patterns or production-pieces from master forms or templates. Fast, powerful, economical, tracer-controlled precision milling in 2 or 3 dimensions.



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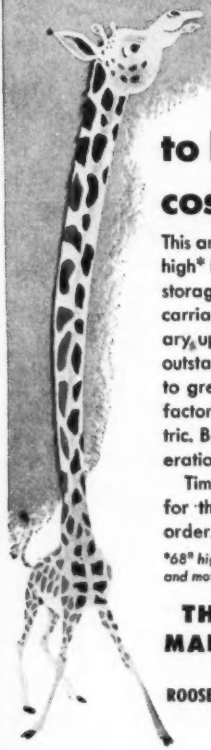

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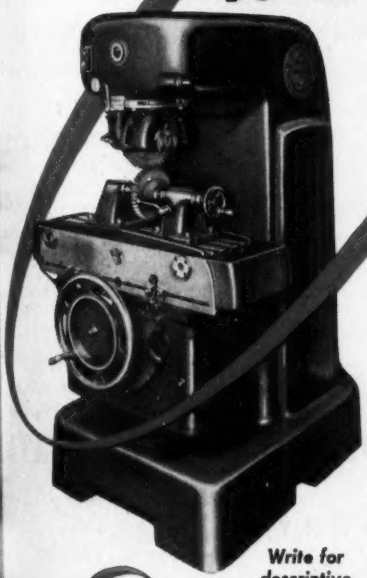

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This gear shaving machine, the first of its kind, was introduced 16 years ago to fulfill the urgent need of gear manufacturers for a means of correcting precision gears and gears produced to operate under critical loads and speeds — these corrections to bring them within required tolerances.

Today, it is being used by all the leading manufacturers in the automotive industry, the majority of gear jobbing shops and nearly all the machine tool builders.

One gear manufacturer says shaving has reduced rejects which formerly amounted to about 50% to none. Another says that shaved gears have cut operating power requirements approximately 20%.

Gear shaving eliminates the need for skilled machinists, regardless of the degree of precision required. Accuracy does not depend on the shaving machine operator. Shaving also makes it easier to turn out acceptable gears. The teeth of shaved gears have uniform accuracy and the characteristics of all the gears in any lot will be uniform.

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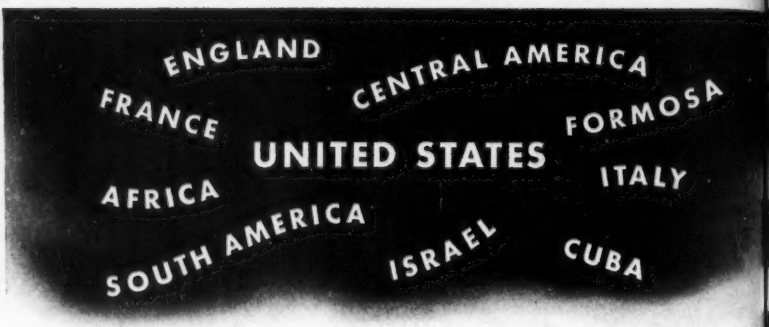

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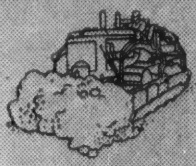

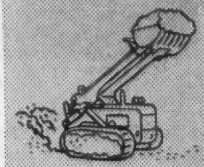

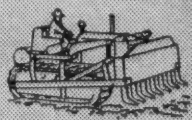

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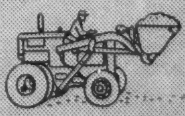

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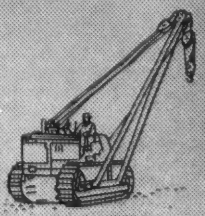

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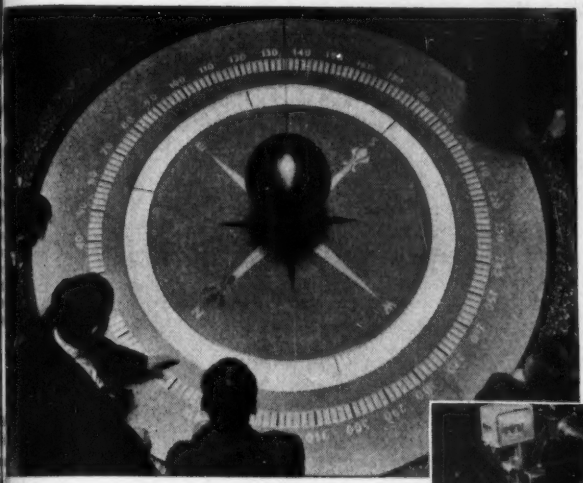
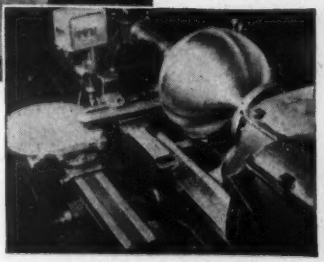


Foucault Pendulum, Chicago Museum of Science & Industry.

Turning perfect hollow sphere for Foucault Pendulum on Monarch Tracer-Controlled Lathe, circa 1935.



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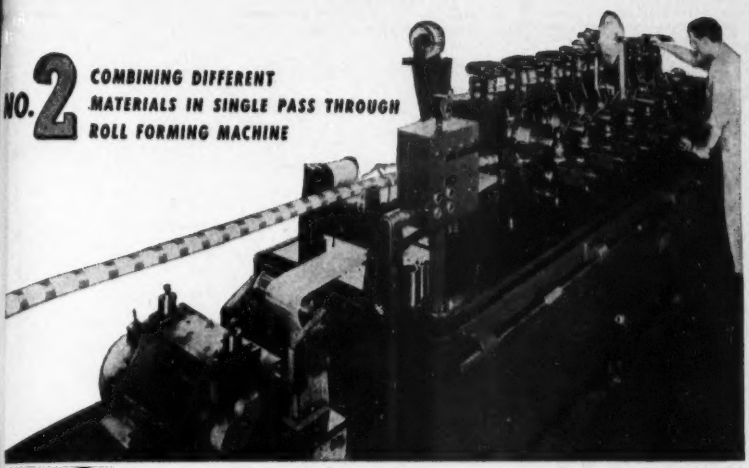

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